Eng.d on Steel by H. Adlard

W.M EMERSON,

BORN 14TH MAY 1701, DIED 21ST MAY 1782.

Engraved for the Mechanics' Magazine Vol. V from the only Original Painting, which is now in the possession of Dr. Cloudsly, of Darlington.

Published June 1826 by Knight & Lacey, Paternoster Row.

MECHANICS'

MAGAZINE.

VOLUME FIFTH.

"The Mechanics' Magazine has, from its establishment, had an extensive circulation; and it communicates, for Three Pence a Week, far more valuable information, both scientific and practical, than was ever before placed within the reach of even those who could afford to pay six times as much for it."—BROUGHAM, *On the Education of the People.*

LONDON:

KNIGHT AND LACEY,

PATERNOSTER ROW;

AND WESTLEY AND TYRRELL, DUBLIN.

M.DCCC.XXVI.

Printed by Milne and Duckworth,
76, Fleet-street.

PREFACE

TO

VOLUME THE FIFTH.

THAT, during a period of distress which has been severe upon all, but which has fallen upon the working classes and the literary world with double weight, the disposition of intelligent Mechanics to read, and to support by their valuable contributions, our well-meant, but unpretending publication, is a proof that its plan is good, and that its utility is felt; and we, as Publishers, having in an especial manner, devoted ourselves to the working classes, feel that we should be wanting in our duty to them, were we not to acknowledge the great favours they have conferred upon us, and offer them our most hearty gratitude for the same.

To those ardent and enquiring minds who have made our pages the means of laying their projects and discoveries before the Public, we feel most peculiar obligation, and we hesitate not to say that, but for them, our efforts, instead of having carried us with triumph to the termination of a Fifth Volume, and opened to us the prospect of a series of future volumes, constantly increasing in interest, of which we can see no termination, would have failed at the very commencement. At the time when the idea of a Mechanics' Magazine was suggested, had it not been for us, that Magazine would have been a work of a very different nature, and of very inferior utility; for it was suggested that it should be a mere literary miscellany; and although the gentleman who, at the first, joined us in the projecting of it (we

mean Mr. Joseph Clinton Robertson,) could not hope for the support which we subsequently experienced, it was not without a good deal of difficulty, that we prevailed upon him to adopt our view of the matter, and attempt to make the "Mechanics' Magazine" in reality, what it was in name.

The success with which the work was honoured immediately upon its appearance, not only justified the preference which we had given to the scientific plan, but induced us to make very great exertions to give every publicity to the Magazine, and to identify it as much as possible with those Institutions for the scientific instruction of Mechanics which were then beginning to be established in many parts of the country. Indeed, we conceive, that for some part at least of the advantages which Mechanics derive from their institutions, they are indebted for the publicity afforded by the Magazine. Unfortunately, however, the connection with Mr. Robertson destroyed the whole advantages that might have been derived by both parties from an intimate connection between the Magazine and the Institutions. That gentleman, upon some private ground of his own, of which we never knew the nature, but which certainly had nothing to do with science, quarrelled with Dr. Birkbeck, and other intelligent and public spirited gentlemen, who took an interest in the London Mechanics' Institution, and so rancorous or so unreasonable was Mr. Robertson in his dispute with those gentlemen, that, in spite of every advance towards conciliation on their part, the result was, a rupture with the Institutions, and the destruction of that hope of mutual co-operation in the cause of Science, which, for a long time, we had so fondly cherished.

Though the loss of this connexion, beside the general mischief that it did by separating those who ought to have been united, could not but have an effect upon the Magazine, still our exertions were unabated; and in so far as either the Contributors to the work or the Public were concerned, we had no reason to complain; although of the manner in which Mr. Robertson discharged his duty to us and to the Public, we did hear complaints, which we were sorry to feel were too well founded. By a reference to all the volumes, it

will be found that they contain no Essay or Criticism upon any one mechanical subject from his pen, but are wholly made up of contributions by the Mechanics themselves.

About the beginning of the present year, we found ourselves overtaken by those embarrassments which, to a certain extent at least, were felt by the richest and longest established houses; and when we were driven to the necessity of appealing to the indulgence of our creditors, we found that this same Mr. Robertson, to whom we certainly never were under any pecuniary (or other) obligation, leagued with another person (the remainder of whose services we had found it prudent to buy up) conspiring to ruin us, by every artifice to which even malignity itself could have recourse. When a Meeting of our Creditors was called, their minds were attempted to be prejudiced against us by pamphlets and statements in the public prints, and these were followed up by a violent abuse of us at the Meeting, by Mr. Robertson, who was then, and who had all along been, a debtor to our estate; and indeed we have no hesitation in saying that, for the hostility, we say the ungrateful, almost the mad hostility of that gentleman, we should not have been driven into the Gazette; and that laxity of exertion, which the necessity of such a step produces, would not have affected, as it has done for a few weeks past, our exertions for the Magazine. Even after a Commission of Bankruptcy had been issued against us, the man whom we had chiefly favoured was our only enemy. Owing to circumstances, indeed, (in all probability from our not being able to furnish him with the same supplies in anticipation of any just demand as before,) he did not make his appearance before the Commissioners, but immediately before the time appointed for our third meeting, he published a statement, in his own name, containing allegations which he did not prove, or ever intend to prove; and at the same time, by placards in the streets, and innuendos in the newspapers, he called upon our creditors not to sign our certificate till they had read his false and abusive pamphlet—a pamphlet in which calumny was heaped as unsparingly upon others as upon us. This Mr. Robertson undoubtedly did solely with a view of preventing us from getting our certificate; but it had the effect

of accelerating that,—evidently from the honest indignation that men of principle felt at such conduct in a man whom we had all along treated with every kindness.

For us to have taken any notice of such conduct, in such an individual, would have been as unpleasant as it was unnecessary. We knew the rectitude of our principles, and the extent of our exertions; and we knew too that our creditors were men and gentlemen; and, therefore, to have noticed the vindictive proceedings of one, who could have no motive, save anger, that he could profit no more at our hands, unless a desire to deepen the misfortune of those who had often befriended him when he was in great extremity, would have been equally repugnant to our feelings and insulting to the understanding of our creditors. The handsome, the liberal, the kind treatment, that we have experienced from them, convinces us that we were in the right; and while the lesson will be useful to us, the pleasure of having been thus treated by men of undoubted honour, more than compensates the persecution* which we have been doomed to suffer from a man for whom we have done much.

When Mr. Robertson found that his attempts to injure and ruin us had not only failed in producing that effect, but had produced, and were producing, an effect exactly the reverse, he attempted, by publishing a professed continuation of that "Mechanics' Magazine," which had been recommended to the public not by any thing that he had done or written, but by our exertions and the labours of the mechanics themselves, at another place. Nor was this all; for he attempted to sell to others, and to prevent our assignees from publishing by us, for the general benefit of our cre-

* Some idea may be formed of the extent to which Mr. Robertson carried his malignant persecution of us, when we mention that we have been under the necessity of taking the opinion of counsel, with regard to certain bills of exchange which we have just found out that he (Robertson) procured to be drawn, and which he himself accepted in the name of Knight, Lacey, and Robertson, under the hollow pretence that there was such a firm. Though this fraud was as clumsy, and in effect as harmless towards us and our creditors as it was malignant, yet the bare mention of it shows the nature and character of the man in a more forcible light, than if a whole volume had been written on the subject.

ditors, other works in which he had no interest or concern whatsoever.

For whatever connection the "Mechanics' Magazine" has in the trade, it is indebted solely to us; and for whatever of value is in the five volumes now before the Public, we are indebted to those who have made it the vehicle of their own communications; and the Public may rest assured that, though the "Mechanics' Magazine" is carried on for the benefit of our Creditors, our exertions in its behalf shall be as strenuous as when it was carried on for our own benefit.

JOHN KNIGHT,
HENRY LACEY.

55, Paternoster-row,
June 30, 1826.

MEMOIR

OF

MR. WILLIAM EMERSON.

William Emerson, whose mathematical and mechanical talents, as well as his eccentricities, were so great, was the eldest son of Mr. Dudley Emerson, of Hurmouth, near Darlington, in the county of Durham. His father, who appears to have possessed some of the eccentricities which afterwards gave so much chequeredness and peculiarity to the character of the son, had more genius than fortune, and thus was obliged to make up the deficiency of a very limited income, by the useful, but then laborious and ill paid functions of schoolmaster. The old gentleman, thinking himself of some consequence in the world, set down, for the benefit of posterity, an account of the most remarkable occurrences of his life, but among these, there were no notices of the subject of this memoir.

Emerson was born on the 14th of May, and baptized on the 10th of June, 1701. He received the rudiments of education—reading, writing, arithmetic, and some slight knowledge of Latin, from his father; and his knowledge, especially of the languages, were carried a little further, by the curate of Hurmouth, who lodged in his father's house. Emerson, whose after life has done the greatest service to the sciences, showed none of that precocity of talent, which attracts the attention of the world, and by leading the boy to believe that he already is an eminent character, bar up the way to real eminence. The idle amusements of youth, and in the season, the search for birds'-nests, formed the chief pleasure and occupation of young Emerson; and in those frivolous courses he spent his time, till he was nearly twenty years old. About that time (though what was the impelling circumstance, has never transpired) Emerson's attachment was drawn toward mathematics, with great fondness and assiduity; and as his mind had, by this time, acquired strength, and was not much distracted by other studies, his attention and consequent progress, were very great. His studies were assiduously carried on first at Newcastle, and then at York; but it appears that he had previously got a taste for the accurate sciences, partly from the instructions, but more from the books of his father.

After his return from York, Emerson continued his mathematical labours, though without giving, or apparently intending to give, any portion of the results to the public; but the final determination to prepare himself for a hearing before the public with advantage, appears to have been prompted by a power which is supposed to have less controul over mathematicians than over any other class of persons. For two years or so after his return from York, Emerson appears to have lived on his patrimony, which, though small, was equal to all his wants; and, some time about the year 1733, he was married to a female of frugal habits, niece to Dr. Johnson, the rector of his native parish. The Doctor had, previous to the ceremony, promised to give his niece five hundred pounds, as a marriage portion; and, some time afterwards, Emerson took occasion to hint, with that bluntness for which he was so remarkable, the propriety of fulfilling the promise. The Doctor not only forgot or denied the promise, but treated Emerson with that haughtiness which a man of professed learning is sometimes apt to exercise toward those who have not had the same advantages as himself. This contempt wounded the pride of Emerson; he left the Doctor with expressions of his indignation, couched not in the most elegant, or even the most proper terms; and no sooner had he reached his own dwelling, than he packed up all his wife's clothes, and returned them to Dr. Johnson, saying, that he would scorn being beholden to such a fellow, even for a rag, and that he would be revenged for the insolence that he had been subjected to, and show the Doctor who really was the greater man. The revenge that he meditated was by no means what would have been looked for from the external appearance and manner of the man. From these, one would have been apt to imagine that Emerson, who, though not of great stature, was remarkably knit and strong, would have inflicted personal chastisement upon the haughty uncle of his wife. But Emerson's revenge was of a more noble character, and he resolved to apply himself to his studies with the greater diligence; until the world should, without any solicitation on his part, confess that he was a greater man than the uncle. Even here the motive, which certainly in so far induced him to study, did not make him come hastily before the world. He waited his full period of ten years, at the end of which, being then in the forty-second year of his age, he published his book on Fluxions, and at once took his station among the most able mathematicians of the time. Perhaps he was induced to make this his first appearance before the world, in consequence of the keen dispute which was then in agitation about the

comparative soundness of the doctrines of Newton and of the continental mathematicians. He was a keen advocate of the Newtonian hypotheses, and, in his book, was at great pains in establishing the algorithm of Fluxions upon the most clear and legitimate basis. As has been the case with the first works of very eminent writers in other departments of knowledge, Emerson did not derive so much popularity from the world in general, as he derived esteem from learned men, by the publication of his Treatise upon Fluxions. Nor was it till he had, at a period considerably later, been introduced to Mr. John Nourse, bookseller, whose patronage of mathematics and mathematicians, and whose knowledge of the sciences are well known, that he acquired that popularity which he received in the latter part of his life, and which his works, notwithstanding their peculiarities of style, continue to enjoy. That gentleman engaged Emerson to furnish a regular course of mathematics, adapted to the capacity of junior students; and while the mathematician was in London, superintending that work, he lodged in the house of a watchmaker, in order that he might there learn the practical part of mechanics, of which he was very fond.

His mechanical turn was displayed in several inventions; but as he never attempted to combine chemistry with the principles of mathematics and mechanical philosophy, the results, except such as are figured and described in his own works, have been lost. His wife's spinning-wheel, which is the best known, and was in all probability his master-piece. As a mathematician, Emerson was, strictly speaking, of the Newtonian school; and though he was by no means one of its most elegant disciples, he was one of the most accurate and laborious.

Emerson has not much to boast of as a man of letters; and saving his mathematical success, he was conspicuous rather for a blunt indifference to every thing elegant, than for any thing else. His language in conversation was remarkable for its coarseness. He spoke out whatever he thought, without any attention to politeness or even to gramatical accuracy; and he did not hesitate to season his speech with those expletives, which are used only by the vulgar. Even in his writings, he uniformly preferred a clear and brief expression of the sense, to any thing like elegance or even purity of style. His prefaces, however, have traces of a mind which could easily have mastered those minor matters; and amid all the crabbedness of his regular works, there is perhaps more clearness, than in the writings of those who are more specious in appearance. If Emerson did not extend the actual boundaries of human knowledge in the way of

discovery, there cannot be denied to him the praise of having made true science familiar to the people, and of having shown that merely scholastic attainments are not indispensable for the acquisition of the greatest eminence in the most obstruse subjects of human study. To the mechanic, Emerson holds out the most inviting example,—that of a man, not receiving more regular education than the majority of respectable mechanics now receive, placing himself, by the application of his talents alone, at the head of the mathematicians of his country for a very long period of time.

The following is a list of Emerson's regular works, with the date of the appearance of each, and the age of the author at the time of its appearance:

Years.	Ætat.	
1743 ..	42	Fluxions, 8vo.
1749 ..	48	Projections of the Sphere, and Elements of Trigonometry, 8vo.
1754 ..	53	Mechanics, 4to.
1755 ..	54	Navigation, 12mo.
1763 ..	62	Arithmetic, Geometry, 8vo.
		Method of Increment, 4to.
1764 ..	63	Algebra, 8vo.
1767 ..	66	Arithmetic et Infinities and Conic Sections, 8vo.
1768 ..	67	Elements of Optics and Perspective, 8vo.
1769 ..	68	Astronomy, Mechanics, Centripetal and Centrifugal forces, 8vo.
1770 ..	69	Mathematical Principles of Geography, Navigation, and Dialling; Comment on the Principia, with the Defence of Newton, Tract, 8vo.
1776 ..	75	Miscellanies, 8vo., which was his last work.

Besides these regular works, Emerson contributed many detached papers to the scientific Journals of his time; and retained the energies of his mind, to the close of a very long life, which terminated on the 28th of May, 1782, soon after he had completed the 81st year of his age.

Emerson was, as has already been mentioned, a man of small size, but very strong and active. His countenance indicated great ardour and independence, and the indication was fully justified by the character and conduct of the man. He was irritable and plain even to rudeness, but his integrity and love of liberty, truth, and justice, were without bounds. Even after he had become celebrated as a mathematician, he did not wholly shut himself up in his closet, but changed his juvenile amusement of birds'-nesting, for fishing in the river Tees, to which he was very much addicted.—The tale of the man is short; the duration of his labours will be long.

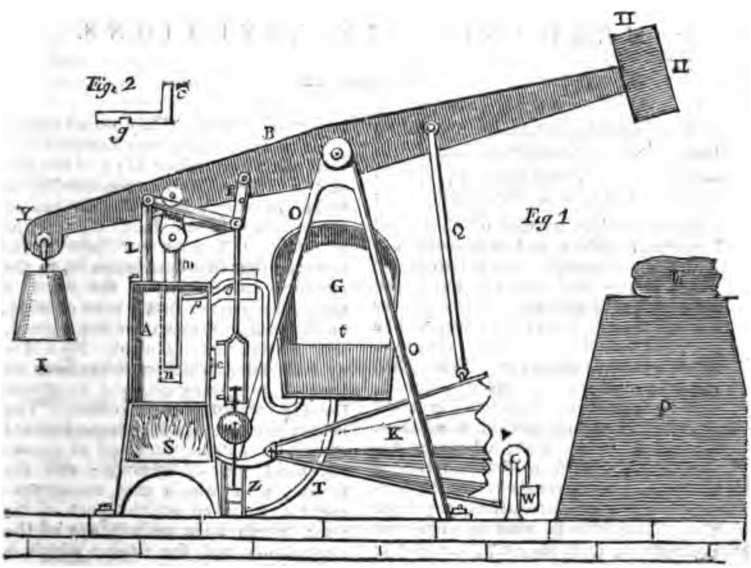
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 113.] SATURDAY, OCTOBER 22, 1825. [Price 3*d*.

"However bad the world may be, the extremes of wickedness are to be found among those who do not read."—*Knox*.

STEAM FORGE-HAMMER.



SIR,—If you think the prefixed figure of a Steam Forge Hammer, and following description, worthy of insertion in your valuable work, they are at your service.

Description.

A, the cylinder, the bottom, *n*, of which is kept very hot by the fire in the stove, S.

B, the beam, vibrating on a centre, C.

D, the anvil.

E, the iron to be forged.

FFF, the foundation or floor for the machine to rest on.

G, a cistern, filled with water as high as *t*, and the remaining part with air.

H, the hammer.

I, a weight, heavy enough to lift the hammer, and to overcome the friction of the machine.

K, a pair of smith's bellows inverted, which receives motion from the beam, B, by means of the connecting rod, Q.

L, an upright shaft, fastened to the top of the cylinder, A, to which the radius rod of the parallel motion, P, is fixed.

R, a rod to let water into the cylinder, move the forcing-pump, Z, and

let steam out of the cylinder. This rod has a hole in it about one-eighth of an inch long; and when the hammer is at its greatest height, as is shewn in the figure, this rod is at the bottom; the hole, *a*, comes opposite to the pipe, *p*, and allows the water to be forced out of the cistern, G, into the cylinder, A (which is made air-tight at top, *m*, and rather broader in the inside, to allow the water to pass to the bottom, *n*), which is immediately converted into steam, and thus gives a very great force to the hammer. This rod at the same time shuts the communication with the atmosphere, by means of the pins, *xx*, and crank, *c*, more fully exhibited in fig. 2. When the end, Y, of the beam is at the top, the bottom pin, *x*, lifts up the crank, *c*, and allows the steam to pass through the groove *g* (which is made in the steel cock, *cg*, exactly to the centre) into the atmosphere, and allows the piston to descend. The piston of the forcing-pump, Z, is also lifted by this rod by the catch, *f*; but as the beam descends, it does not force down the piston, but lets the weight, *w*, force the water up the pipe, T, according as it is consumed.

w, A cock, for stopping the engine.

I remain, Sir, yours truly,

R. W.

Huddersfield.

MECHANICS' INSTITUTIONS.

The following remarks are taken from the last Number of the Edinburgh Review, and are supposed to be from the pen of Mr. Brougham:

Since we last treated of this most important subject, and endeavoured to administer consolation to the wounded spirit of the High Church party and other lovers of darkness, many similar establishments have been formed. The desire of knowledge spreads with each effort made to satisfy it. The sacred thirst of science is becoming epidemic, and we look forward to the day when the laws of matter and of mind shall be known to all men; when an acquaintance with them shall no longer be deemed, as heretofore, the distinction of a few superior minds, any more than being able to read or write now constitutes, as it once did, the title to scholarship.

* * * * * * * * *

In all, or almost all, the Institutions lately formed, it is truly gratifying to observe the sound principles which have been adopted. The whole body of contributors and subscribers are on the same footing of members and proprietors; the management is entrusted to committees, of which two-thirds, at the least, must be working mechanics; and the funds are, as much as possible, raised by the subscriptions of the working classes, in order to secure the permanency of the Institutions, and to avoid the feeling of dependence. These are the true fundamental principles of this important system. They are all recognised in the rules of the Ashton Establishment now before us; and the last of the three is well commented upon in Mr. Hindley's Address, delivered on the opening of the Institution, June 22, 1825. "You are not (says he) to imagine that this Institution is, in the common acceptation of the word, a CHARITABLE one; that it is an offering, on the part of the rich and the learned, to the poor and ignorant. No! it is an Institution which requires from all its members value received in return for the advantages it offers. The higher classes of society come forward at first to extend the hand of *encouragement*, not of *charity*; and the feeling with which that encouragement is received on the part of the poor, needs have no mixture of the dependence and the shame which is always the companion of the almsman on the rich man's bounty."

The example of the original London Institution has, as might be expected, been followed in the metropolis. Under the auspices of Mr. Gibson, and other most respectable individuals, an Institution has been formed for the Eastern parts of the city, in the Spitalfields districts, and we believe that steps have been taken to establish one in Southwark.

Among the remoter parts of the country, Northumberland certainly stands conspicuous. Mr. Losh, the zealous and enlightened friend of every good work, himself a man filled with

various and useful knowledge, and whom an habitual love of classical literature has only made the more anxious for the education of the people —Mr. Turner, who, among the first, years ago opened the doors of his Lecture-room to the mechanics, and who is not more distinguished as a pious and learned divine, than as an acute natural philosopher; with others, whose names would, had we space, adorn our pages, have so strenuously exerted themselves in this great labour, that we understand there is scarcely a single market-town in the country without a Mechanics' Institution, excepting Afton, and there proceedings have been commenced for founding one. The gratuitous lectures of Mr. Turner, at Newcastle, are very numerously attended by the mechanics, whose attention and regularity are highly commended by the learned professor. How truly *pious* is this discharge of his duty! How greatly to be esteemed, beyond the waste of temper, as well as of precious time, in bootless controversy! How infinitely to be prized, before the base and sordid spirit that seeks emolument by affecting a zeal about civil or ecclesiastical distinctions, or licking the dust trodden under the feet of those who hold the keys of preferment!

The suggestions that had been circulated from London through the country, have been effectual to another good purpose—the extension of similar associations to country labourers as well as artisans. Farmers' Book-clubs have been formed in several places; and we trust that the excellent plan of circulating libraries, adopted in East Lothian, that is, libraries which are transferred from one village to another in succession, and used by the inhabitants both of the villages and the neighbouring country, will be imitated elsewhere.

The system, indeed, appears to be working in every direction, and in remote and in inconsiderable places. In spring a beginning was made at Newport, in the Isle of Wight, a town of very moderate size, containing only about 4000 inhabitants. A Tradesman's and Mechanic's Library was formed under very judicious regulations, the subscription being six shillings a-year, or 1*s.* 6*d.* per quarter. The number of members soon exceeded 260, and, by means of donations, the library in a few months consisted of 500 volumes. There is nothing more useful than to promote the practice of such donations. Almost every man who has a few shelves full of books, has some volume or two useless to him, either as duplicates, early editions, or works the contents of which others present in a better form. The movers in founding an Institution, should bestir themselves to obtain gifts of these books, which are invaluable as the beginnings of a library, and of no value to the owners. Lectures have been added at Newport, by the worthy and enlightened Secretary, Mr. Abraham Clarke; and others have signified their intention of taking a similar part. In truth, it requires no professional lecturer to perform this important office. He who has learnt—even he who *is learning* chemistry, natural philosophy, or natural history himself, may render the greatest service in explaining those sciences to others who have not the same leisure, or the same command of teachers, books, and apparatus. In the Newport Society all subscribers are members, and two-thirds of the Committee of Management are mechanics, according to the just principles.

Meanwhile the central establishment in London has flourished beyond the most sanguine expectations of its most enlightened supporters. The foundation of the Theatre was laid about Christmas, and on the 8th of July it was completed and opened by the distinguished founder, Dr. Birkbeck, supported by his Royal Highness the Duke of Sussex, the Marquis of Lansdown, Sir Robert Wilson, Messrs. Brougham, Wood, Hume, Martin, and other zealous friends of popular education, some of whom addressed the meeting after the Doctor had closed his admirable lecture. The premises are spacious and elegant, though perfectly simple, consisting of a commodious house, in which there are large apartments for the library, apparatus, reading-rooms, and the secretary and other officers. The Theatre is a fine and lofty hall, where above a thousand students can easily be accommodated. The lecture of the learned President was a most interesting dissertation upon the advantages of intellectual pursuits, and contained many anecdotes of the shameful ignorance which in former times pervaded all ranks, even the highest in the state. It is to be wished that this discourse, or the substance of it, should be published, both in remembrance of the occasion

upon which it was pronounced, and for its intrinsic usefulness. We have called Dr. Birkbeck *the founder of this building;* and well we may, for he advanced the money (several thousand pounds) which purchased the house and erected the Theatre. Other magnificent donations (especially Sir F. Burdett's, of a thousand pounds, and his able, accomplished, and excellent colleague, Mr. Hobhouse, of a hundred) have been duly appreciated by the country. *It is, however, only just to the working mechanics themselves to state, what we have good reason to know, that had no such helps been at hand, they were firmly resolved to raise the needful sums among their own body; and, from their numbers and respectability, there can be no doubt that, in a few months, they would have accomplished this favourite object.*

BRIGHTON.

Mr. M. Ricardo has commenced a course of Lectures at the Institution in this town on Gas Lights, and on the principles of Artificial Light in general. He stated the plan of this course to be—to give a short history of the first introduction and progress of gas lights, a description of the different apparatus used, a theoretical view of the principles of artificial light, and how it is produced; then to exhibit the mode of making coal gas—oil gas—to explain the operation of producing portable gas—to exhibit different lights, and to show the mode of measuring their intensity. In his first lecture last week, Mr. R., after a short introduction, gave a slight sketch of the rise and progress of gas lights, and then commenced his explanation of the various apparatus used; he had provided himself with suitable models, and the Lecture excited great interest.

SUNDERLAND.

We are happy to hear that the Mechanics' Institution of Sunderland is proceeding as prosperously as the most enthusiastic promoters of these valuable Societies can desire. The number of the members is now 320, and the course they adopt is such as can scarcely fail to make them increase progressively. They have, for some time past, had a lecture delivered on some scientific subject weekly, and should any circumstance occur to prevent this, their practice is to select a text from a work of reputation, like Parke's Chemical Catechism, that gives rise to a debate, in which all are invited to participate, and which always produces some useful illustration, if it advances nothing in discovery. They had lately three valuable lectures on caloric delivered to them gratuitously by Dr. Brown. They have already three classes formed for mathematics, natural history, and chemistry, which meet regularly, and are making evident progress. We trust their example will be followed by Mechanics' Institutions in other towns; for though they may do much good merely as Book Societies, there can be no doubt that their usefulness would be incalculably increased, if there were certain periods set apart for a lecture, even if it were ever so homely or familiar, in some department of science.—*Tyne Mercury.*

STOCKPORT.

At a public Meeting of the Manufacturers, Tradesmen, and other Inhabitants of this town and neighbourhood, held on the 8th of September, Thomas Marsland, Esq. Mayor, in the Chair, it was unanimously resolved to establish a Mechanics' Institution; that Peter Marsland, Esq. should be President; and Thomas Marsland, Esq. Richard Heywood, Esq. (of Manchester), Joseph Lane, Esq. and James Heald, Esq. should be Vice-Presidents; and that "every benefactor of ten guineas or upwards at one time, and every subscriber of one pound per annum, be honorary members, in whom shall be vested the entire management of the Institution; and that every subscriber of twelve shillings per annum, shall be entitled to all the advantages the Institution may be enabled to afford, but shall not be eligible into any office connected with its management."

It will be seen from this last provision, that this Institution is intended to be an exception to the more general plan, recommended by Mr. Brougham, and advocated by us, of leaving the management chiefly in the hands of the mechanics themselves. The twelve shillings subscribers will most likely be all of the humbler classes.

Mr. Heywood, whose excellent address, at the opening of the Manchester Institution, we brought some time ago under the notice of our readers,

delivered also the Inaugural Address to the Stockport Institution. We extract from it the following appropriate remarks :—

"The mechanics of this country have been long distinguished above those of others, for the successful application of science to the mechanical arts. In the march of improvement they have found few competitors; for, whilst war, with all its horrors, has been desolating the other nations of Europe, crippling their energies, and bowing their spirits to the dust, England, under the superintendence of a gracious Providence, has been permitted to enjoy the blessings of peace and tranquillity. Her husbandmen have reaped in security what they had sown in confidence ; the energies of her mechanics, unchilled by the fear of an invading enemy, have been steadily directed to the improvement of their respective arts ; and notwithstanding the efforts of those who would willingly have annihilated her commerce, her merchants have still penetrated with her manufactures to the uttermost parts of the earth. With such advantages, and possessed of resources which no other nation ever possessed, we need not wonder at the pre-eminence which England has attained. The return of peace, however, to desolated Europe, has stripped her of many of those advantages: other nations have entered the course, and are straining every nerve to overtake her: they have witnessed her prosperity, and have correctly judged that her manufactures alone have been its cause. Fired by her example, and availing themselves of much of her experience, they have determined to trace her footsteps, as the only path to national greatness. Thus, it will be perceived, that the relative position of this country, in so far as its manufactures are concerned, is materially altered—that instead of reigning, as it has done, the only manufacturing nation of eminence, it must be content to compete with others for the prize, which will be adjudged to the most worthy: and hence the question arises—How shall we maintain that pre-eminence in the hour of danger, which we have gained in the moment of security? The answer is contained in the words of our immortal philosopher—"Knowledge is power." This short sentence contains the grand secret of our unequalled prosperity. The knowledge possessed by our scientific mechanics, which has been applied to practice under circumstances so favourable to its operation, is the basis of our fame, and on this must we rely for our security and advancement."

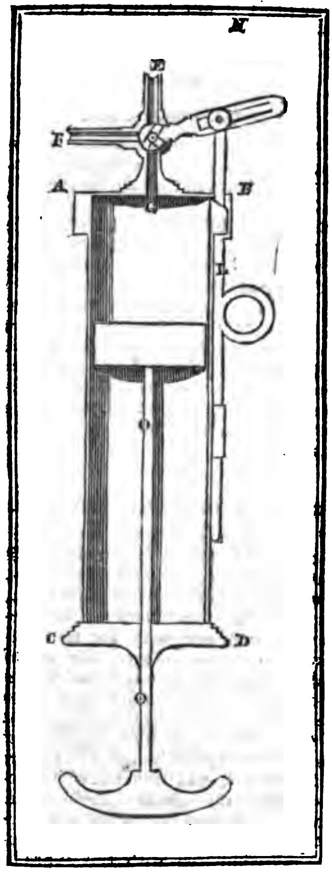
ASHTON-UNDER-LYNE.

Mr. Heywood, in the course of his inaugural address to the Stockport Institution, observed that the Mechanics' Institution of Ashton-under-Lyne had not been established more than three months, and, on the authority of the President, he was enabled to state that a material alteration had already taken place in the mechanics of that town. Upwards of two hundred members have been enrolled on the books of the Institution, and the zeal and attention they display in the attendance of lectures, and their frequent visits to the library, have astonished their warmest friends.

FRENCH MECHANICS' INSTITUTIONS.

At the last sitting of the French Institute, M. Dupin, presenting his course of Geometry and Mechanics, combated the opinion of those who imagine that the knowledge of geometry is only necessary for the construction of machinery. He stated that upwards of 150 arts and trades would derive great advantage from the artisans being instructed in that science. M. Dupin took a glance at the relative state of industry in France and England, and was forced to acknowledge the great inferiority of France; and cited, as a proof, the stagnation of French commerce and manufactures compared with the "prodigious augmentation of the commerce of England. It is not (said he) that we have gone back, but England has made an infinitely more rapid progress." He added, that it was only in the mechanical arts that England excelled. For example, chemistry in France is far from being behind that of any other nation. The Bertholletts and Fourcroys had persuaded the Government to found establishments for facilitating its progress. It will be the same with the mechanical arts, if analogous establishments are encouraged. Already the schools formed in different towns of France, and the lectures given in them, give the brightest hopes.

IMPROVEMENT ON JUKES' STOMACH PUMP.



SIR,—Mr. Jukes' invention for extracting poison from the stomach having been, unfortunately, called into use in this place a short time ago, and the person operated upon, though in skilful hands, having suffered considerable pain and inconvenience from the difficulty experienced in opening and shutting the taps attached to the apparatus with precision and dispatch, I was led to the contrivance of some means for obviating the difficulty on future occasions, and, from the working diagram which I have forwarded, you will gather the result of my cogitations.

Should you think my improvement (if it be worthy of such a title) deserving a place in your interesting publication, you will oblige me by devoting it to the public.

Since the present improvement was designed, I have learned that Mr. Weiss, a celebrated surgical-instrument maker, has also made a successful attempt to improve Mr. Jukes's truly valuable apparatus; but as mine certainly possesses simplicity and certainty of action, probably some may give it a preference; at all events it may to some one suggest a still further improvement.

I have now in my possession a pump altered according to the diagram, which has met with the approbation of several medical men who have tried it.

I am, Sir,
Your obedient servant,
R— C—.

Newark.

Reference to the Diagram.

A, B, C, D, represent the cylinder or syringe.

E, F, G, a double tap, having a plug containing two orifices, one (H, I) running through in a direct line, the other (K) cut transversely, so as to meet the passage (H, I) at right angles.

L, a sliding-rod attached to the arm, M, by means of which the plug of the tap may be turned so as that a communication between the two apertures, E and F, and the syringe, may be opened or closed at pleasure.

Directions to the Operator.

The accompanying tubes being affixed to the noses of the tap and the one attached to the point, E, being introduced into the stomach, the operator must grasp the syringe with his left hand by placing his hand under it and his middle finger within the ring affixed to the rod, L; then, by sliding the hand down the syringe, the arm, M, will be forced to the point N, and a communication opened with the stomach. The syringe being filled while held in the above situation by withdrawing the piston, O, the operator must slide his hand back, drawing the arm M to the point B, which will close the communication with the stomach,

and open the one from G to F, by which the contents of the stomach may be ejected, and so on till the stomach be cleared; then, by reversing the order of the motions, warm water may be introduced into the stomach, and again withdrawn with great speed.

DOUBLE CYLINDER STEAM-ENGINES.

SIR,—I feel extremely gratified with the scientific answers my letter, relative to Wolf and Co.'s Steam-Engine, has been honoured with. From the answers of your Correspondents being so nearly alike, I feel confident that the opinions they have expressed are those which are generally entertained; I must still, however, beg leave to differ from them. Your Correspondents dwell on the additional power to be gained by the difference of the size of the cylinders. Now, were the steam admitted from the same boiler between two cylinders and pistons of different sizes, there is no doubt but the larger one would possess the advantage. But this will not hold good as it regards the engine in question, for I believe it will be found agreeable to the rules of both "mechanics and mathematics," that whatever power you have upon the low-pressure piston, you must have a resting-place from which that power is resisted. Thus, when the steam is admitted into the cylinder of an engine, either of high or low pressure, the steam acts with equal power upon the bottom or cover of the cylinder that it does upon the piston; and it will be found the same in Wolf and Co.'s engines, that whether the resister is the bottom of the cylinder, or the high-pressure piston, the result will be the same—a resistance equal there must be. I am aware it will be urged, that these engines do more work with the same quantity of fuel, than either the common high pressure or the condensing engine. This, however, is not owing to its double action, but to the steam passing through the low-pressure cylinder being brought down to a temperature sufficiently low to be condensed, and form a partial vacuum.

The engine of Mr. Pattison, first described in your 108th Number, I have no doubt will be found to exceed that of Wolf and Co. considerably, inasmuch as it will have all the effect I have just mentioned, without having the friction of the second cylinder, &c. to contend with. I am willing at any time to be engaged to make a high-pressure engine upon such a principle, that it shall exceed in power, according to the fuel used, any one that can be made upon the principle of Wolf and Edwards.

I am, Sir,

Your constant reader,

F. J—K—N.

INCREASE OF THE SOUND OF ARTILLERY.

SIR,—From observing how the power of the human voice was increased by the speaking-trumpet, I was led to think, that if the muzzle of a gun was made of that form, it would have the same effect on its report when fired, and immediately resolved to try the experiment. I fixed a mouth-piece, about the size of a bugle, on a common pistol, and accordingly found the report increased in a surprising manner. A piece of artillery, no doubt, would require a mouth-piece much larger than this to have a corresponding effect; and it would have to be made so strong, as not to be shaken by the violent concussion. This discovery, I dare say, will be of little moment to the public; unless, indeed, when they wish to show the extent of their satisfaction by the greatness of the noise they make—I mean when they rejoice; and I think it will be the opinion of most people, that the report of a cannon is quite loud enough already.

I am, Sir,

Your most obedient servant,

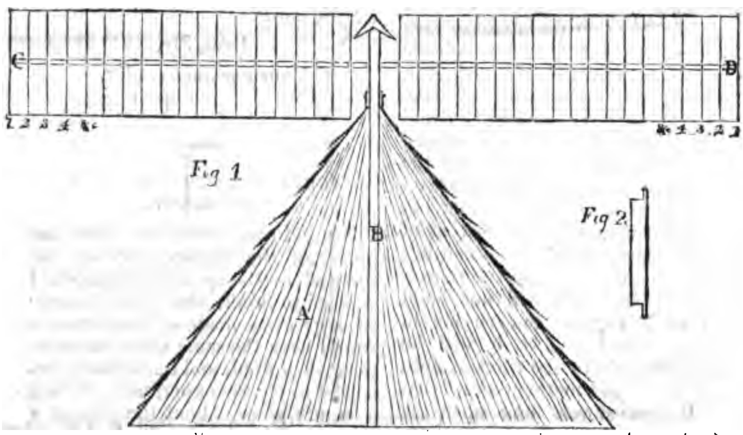
JOHN WELSH.

Newton, near Alnwick.

PERIODIC TIME OF THE MOON.

We observe, in the Liverpool Inquirer for the present month, an interesting paper on the periodic Time of the Moon, by Mr. J. Baines, of Ebor House, in this neighbourhood. Mr. B. seems to have proved, upon those principles of gravitation on which Sir I. Newton has established the system of the universe, that if the solar action upon the moon should cease, or, in other words, if the sun should be annihilated, the moon would continue to revolve round the earth; but instead of performing its revolution in 27 days, 7 hours, 43 minutes, and 5 seconds, as it does at present, it would then take 48 days, 21 hours, 50 minutes, and 3 seconds, to perform the same. —*Leeds Intelligencer.*

WIND LATHE.



SIR,—You will doubtless have descriptions of the best method of constructing this apparatus (see Inquiry, No. 145, page 350, vol. IV.) from more able hands, but the following remarks and description of the 'arms' may be serviceable.

I think that four arms are sufficient, or superior to a greater number, for the wind cannot act on more than one at once, and, with four, before the wind has lost its full action on one, another will be coming into play. The arms can be made of any length or depth, according to the power required.

I will attempt to sketch a pair of arms, or section of the top of the shaft, upon what I conceive to be a good principle.—(See the prefixed figure).

Description.

A (fig. 1) is the top of the house.

B, the perpendicular shaft.

C and D, two wings or arms.

1, 2, 3, 4, &c. are narrow slips of board (see fig. 2) similar to a Venetian blind, and falling together towards the shaft B.

The wing, C, is represented open.

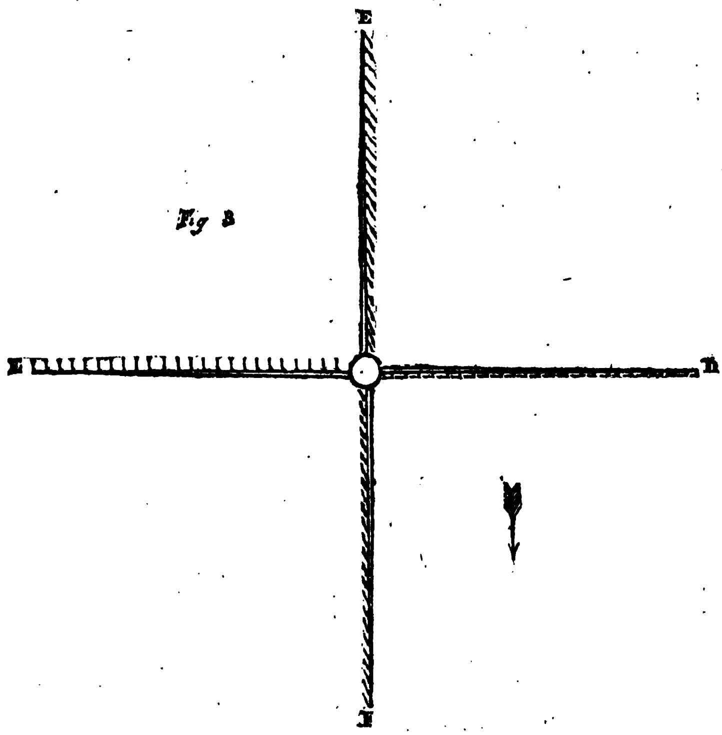
The wing, D, closed, as when the wind is acting upon it.*

Fig. 3 is a horizontal section of the shaft and wings. The wind blowing from F to E will close the wing F, act fully on the wing D, be neuter on the wing E, and have a free passage through the wing C.

---

* From want of shading, this is not so well represented in the drawing as it should have been.—EDIT.

Fig 3



If you should find the present rough sketch worthy of insertion, I will, if it be necessary, give further particulars at some future time.

Believe me, Sir,

Yours respectfully,

R— H—.

P.S. The above has one peculiar advantage over the Battersea Mill, mentioned by a Correspondent in No. 109, namely, that it will serve for all points of the wind without any shifting: the shifting apparatus, and the trouble of shifting upon every change of the wind, are both dispensed with. The same property belongs to the American Mill, described by Clio, at page 212, vol. IV. of which the above sketch is only a variation: it is merely substituting a self-acting vane for the sails.

ARDUOUS WORK WITH THE DIVING BELL.

Sir,—On a beautiful headland, called Cremill Point, which stretches above a mile and a half into Plymouth Sound, it is resolved to erect the chief Victualling-Office for his Majesty's navy—a more suitable place is no where to be found on the whole coast of Britain; and when finished, according to the plans of that eminent engineer, Mr. Rennie, like the Breakwater and Eddystone Lighthouse in its neighbourhood, it will form one of the most prominent objects of art and utility to be seen in the world.

For some time back the work has been going forward, and in excavating the rock on which to lay down the foundation of the sea-wall, the diving bell has shown itself more

than ever an engine by which mankind can really accomplish wonderful tasks, so much so, that, for the benefit and amusement of mechanics, a brief account may be welcome.

The waters of Hamoaze (on whose bosom repose in peace so many of our noble war-ships), while moving to and fro into the Sound with the ebb and flow of the ocean, have caused one of the sides of the shore of Cremill Point to dip from the land with a great declivity; twenty yards from high-water mark, and less, the sounding is above twenty-five feet; and beyond this a *sea precipice*, if the expression may be used, almost descends perpendicularly to the depth of fifty. On the brink of this precipice the sea-wall is to stand; so that ships of any burden, although they draw twice as much water as they do, may come alongside at *low water*, if they please, and be victualled.

From the land, a wooden stage runs out, the standards of which are shod with iron, to fix on the rock, and they are held down by large stones bolted to them. On this stage the diving bell is wrought in a moveable frame, which gives it a command of the bottom of more than twenty feet square; while beside it, in a boarded house, the air-pump stands, which ever keeps in supply the bell-men boring the hard limestone rock beneath. But hardness is not the worst property belonging to it, for it lays the *wrong way*, as quarriers term it; that is to say, its *strata* and *slope* toward the deep (which is nearly a yard vertical for a yard horizontal) run contrary to one another, and cannot be moved by any power but gunpowder, which is put in tin canisters, and inserted in the holes bored; to each of these canisters is attached a small tube of the same metal, about four feet long; when a shot is charged, and put in its place, the signal by the bell-men to those at the top is given, and the bell is hoisted up until the water comes within a few inches of the mouth of the tube, which *mouth* is made wide, like that of a small trumpet, in order that another tube may be fixed in it, which is done water-tight with white lead; another length brings it above the surface, when it is fired by letting a small tube of red-hot iron run down. No agitation worth speaking of, takes place in the surface-water, but the percussion operates on a boat's bottom near it, and will cause it to leak. The boat that held the fire which supplied the iron matches has been therefore rendered useless, and a raft, of short logs bolted together, now answers the purpose better.

This operation of blasting takes place always at low water, when there are from eight to ten feet of water on the shotless labour, and tubing to correspond; though it is a question as yet unsolved, whether a shot at high or low water, of the same extent of *bore*, will do the most execution. The tin tubing is never all destroyed by one shot—probably *one length* is lost, the rest answers another time. When the shot is fired, the tubing leaps out of the water, and is caught by the bell-man.

I have been thus particular, from the hope that some *better invention* than the one now in use may be discovered, for blowing rocks under water; although, I am sorry to say, that in *blowing rocks upon land*, nothing new has been discovered from the first attempt, which took place some hundred years ago. It is singular, too, that no mechanical art can be applied to the jumper, in order to lessen this most laborious of all labour, and which is much more so nearly thirty feet beneath the water, in a diving-bell, where the pressure acts on the lungs very much. When any great exertion is made, the *mouth* is obliged to be *opened wide*, in order to give the breast its needful allowance. In summer, when the air is very rare, it is more difficult to work in the bell than in winter; and what is rather strange, custom never does away with that nauseous feeling we have in the ear and on the glands of the neck, on being let down in a diving-bell. Those quarriers who have wrought in it for years, feel the sensation every time they are let down into the deep, the

same as strangers do. It is a sensation much like that felt when learning to blow a trumpet, or in compressing air with the mouth. Some have it much worse than others; and to those who have a stoppage in the ears, or who are troubled with deafness, I should recommend them to try if the diving-bell contained a cure, as I think it does.

Yet this is not all the bell-men quarriers have to surmount at the Cremill Point: from the steep slant of the rock, the sea-side of the diving-bell is commonly two or three feet from the bottom; so the poor fellows bore away, quite happy, and generally very healthy, up to their middle, and more, in water. The excavation is shoved from under the bell, over the brow of the before-mentioned precipice.

But the chief part of this business of excavating lies in giving the slope of the rock the other way; for the foundation of the wall is not to be level, but to be three feet deeper at the back than at the front: this is because the wall is not to be perpendicular, but curvilineal, with a radius of seventy-one feet. This is the kind of wall nature requires in such situations, for the curve or arch of this radius is what may be termed the *sea-surge curve*, and is to be seen on all shores having beaches of pebbles. This *curve* was first discovered by Mr. Smeaton, and happily applied by him in the erection of his monument, the Eddystone Lighthouse, and since applied by engineers to sea-walls, and walls of counter-pressure, being found to answer the end better than any other.

I must not trespass more on your room at this time, although I would wish to explain many matters more in full respecting the diving-bell, which have not yet, I believe, been treated of by any person.

I am, Sir,

Your humble servant,

A MECHANIC ON THE WORK.

[We shall be glad to hear again from our Correspondent.]

IMPROVEMENTS IN SHIP-BUILDING.

SIR,—I was preparing a paper for insertion in your interesting Magazine, on the subject of Steam Vessels, but by an article (p. 419, vol. IV.) entitled "Naval Improvement," the necessity for it is in a great degree superseded; nevertheless, as the author does not embrace all that I had to say, I request permission to add a few further remarks on the subject.

I quite agree with Colonel Beaufoy, that the shape of the hull is of the first importance in the art of ship-building; and since the figure of a solid of least resistance has long since been determined by Sir Isaac Newton and others, it might be well to try the experiment by building on this plan, provided such be thought applicable to ships' bottoms; but as Nature is perfect in all her works, the nearer we copy from her, the less likely we are to err. I would, therefore, recommend the shape of some of the fastest swimming fish as a model for our steam vessels. We see, among land animals, that the greyhound and the stag are exquisitely formed for speed; and there is no doubt but that the shape of those fish, whose habits require swift motion, is also wisely adapted to the element in which they are destined to move.

On coming up the river a few weeks ago in a steam-boat, although the tide was with us, I observed a considerable surge, or swell of water, around her bow, which I do not doubt tended much to impede our progress; and it occurred to me, that if a sharp beak could be fixed to the head of the vessel, which, by first cleaving the water, should do the same office as the coulter to the plough, it would very much diminish the resistance, and, of course, increase the speed of the vessel.

This beak might be made sufficiently light, so as to hoist up by a tackle, or unship at pleasure. How far the keeping it well greased, or spread over with some unctuous matter, not likely to wash off in a short voyage, might be of advantage in overcoming the friction of the water,

experiment may determine. I am apt to think that it would be found as useful a practice as that of wetting the sails when sailing against the wind. That the water causes considerable friction, is evident from the well-known experiment of pouring a small quantity of oil upon a pond or lake, agitated by the wind, which soon spreads, and produces a smooth surface, the wind then not having power to ruffle it. The advantage of such a practice is further evident, from the slippery skins that most fish are clothed with, which, as Nature does nothing in vain, is manifestly with the design of facilitating their movements in the fluid that surrounds them.

Since the conveyance by steam-boats is now become so general, any improvement in them would be esteemed an object of national importance. I would, therefore, recommend to those who have leisure, and the advantage of a suitable piece of water, to institute a set of experiments, with models of boats of various shapes, in order to ascertain which would pass through a given space, in a given time, with the least resistance. More information as to the manner of conducting these experiments, may be gained from Hutton's Mathematical Dictionary, *verbo Resistance*, and from Dr. Helsham's Lecture on Friction and Wheel Carriages.

I am, Sir, yours, &c.

LEGIS.

October 14th, 1825.

ETRUSCAN VASES.

Professor Hausman having instituted an inquiry into the composition of these Vases, has come to the following conclusions:—1. That the manufacture of earthen vases, appropriated to funeral occasions, had been widely propagated at a remote period of antiquity, with little deviation from a general plan, in so far as regards their principal circumstances. 2. That these vases have been formed with much particular diversity in regard to less important circumstances, such as the quality of the clay employed, and differences in the forms, ornaments, and paintings, not only in different countries and at different times, but also in the same countries and at the same period. 3. That the finer sort of these vases are superior in regard to the preparation of the clay, and the elegance and variety of the forms, as well as the care of the paintings, to all others of the kind, whether of Roman or of modern manufacture, insomuch that the pottery of the most remote ages forms the model of that of the present times. 4. That the art of manufacturing these vases, as practised in very remote times, is much more worthy of estimation than our best performances in that way, since the ancients were not in possession of many assistances which are applied to the art by us; and because some things which are now done without difficulty, by means of certain instruments or machinery, were, in those times, perfected by means of the hand alone, by the greater dexterity of the artists.—5. That certain circumstances were peculiar to the very ancient arts of making and ornamenting those earthen vessels which have evidently been lost in later times, of which may be mentioned in particular the composition of a very thin varnish, which gave a heightening to the colour of the clay in a greater or less degree, and afforded a very thin firm black coating, retaining its lustre to the most remote ages, and capable of resisting the action of acids and other fluids; so that the modern art of manufacturing pottery ware may be materially improved, not only with regard to the forms and ornaments, but also the preparation and application of the materials, by a diligent and continued examination of those very ancient vases.

BIRDS MISTAKEN FOR METEORS.

An account recently published by Professor Hanstein, of a Shooting Star seen in the day-time, has excited a good deal of speculation among astronomers. Mr. Dick, a writer in the Quarterly Journal, has

now shown, however, pretty clearly, that it could be nothing else than a bird. Whilst making observations, twelve years ago, on Venus, when close to the sun, he, whilst looking for the planet, remarked a body passing across the field of the telescope, apparently of the size of Venus, but varying a little in this respect; at first it was mistaken for the planet, but its rapid motion corrected the error. In some instances four or five of these bodies appeared to cross the field of view, sometimes in a perpendicular, and at other times in a horizontal direction. They appeared to be luminous bodies, somewhat resembling the appearance of a planet, when viewed in the day-time with a telescope of a moderate power. Their motion was rapid, and inclined to a waving or serpentine form. After twelve months' observation, Mr. Dick was enabled, by observation of some which were larger than others, to decide they were *birds*, whose bodies, illuminated by the solar rays, reflected light enough to produce the appearance. In a hot summer's day, when a similar phenomenon has been observed, there was every reason to attribute it to a number of winged instruments flying at no great distance from the telescope. Mr. Dick observes, that Professor Hanstein's account of the kind of motion as being unequal, and resembling that of a rocket, corresponds to the motion of birds through the air. He remarks too, that an appearance observed by the late Mr. B. Martin, of certain bright round bodies running towards the sun, when viewed in particular circumstances, may be explained in the same manner.

NEW-INVENTED SILK LOOM.

A Loom has recently been made at Lyons for Silk-weaving, which has many advantages. It is composed of five stages, and the mechanism, which is simple, allows one man to weave five pieces at the same time. The loom has been examined by the Commissioners from the Academy of Lyons, in company with Mons. Jacquart, the inventor of that sort now in use, and which was imported into England with great haste, tending to prove its great advantages. M. Jacquart is of opinion that the new invention is of great importance, and he has pointed out some improvements in it. The inventor is M. Lebrun, and the Academy intends to confer a gold medal on him. By this loom a saving will be made of four-fifths in the expense of labour—*Courier Français.*

FLEXIBLE MARBLE.

"As hard as marble," is a common simile; and yet flexible marbles may be had in abundance. The most remarkable of this sort are those found at West Stockbridge, Lanesborough, and New Ashford, in the United States. The flexibility and elasticity of this stone may be shown as it stands upon one end, by applying a moderate force to the middle or the other end. Its flexibility is seen, too, by supporting the ends of it in a horizontal position upon blocks. The marble has various colours, nearly white, with a reddish tinge, gray, and dove-coloured. Some of it has a fine grain; other specimens are coarsely granular, and have a loose texture. It is not uncommon for one side of a large block to be flexible, while the other part is destitute of this property. It takes a good polish, and appears to be carbonate of lime, and not a magnesian carbonate. It is well known that Dolomieu attributed the flexibility of the marble he examined to exsiccation, and that Bellevue ascertained that unelastic marble might be made elastic by exsiccation. The flexible marble of the United States, however, loses this property in part on becoming dry. When it is made thoroughly wet by the operation of sawing, or of polishing, it must be handled with great care, to prevent its breaking; and the large slabs of it cannot be raised with safety, unless supported in the middle as well as at the ends.

LESSENING THE DRIFT OF SHIPS AT SEA.

A Mr. Burnet, of London, has taken out a patent for this purpose. It consists in letting down to the windward a square plane, attached to a floating plank, with chains eleven feet long from the angles at one side to those at the opposite sides, connected in the middle by a loose ring, to which a hawser is to be fastened from the ship; a cord also passes to the ship from each end of the plank to direct the position in which this is to lie with respect to it. The square plane being directed by the cords to lie at right angles to the drift of the ship, and not being moved by the wind from lying very low in the water, will, of course, in being drawn forward by the hawser, make a resistance to the motion of the ship to the leeward, proportional to its hold in the water, which will be equal to its surface multiplied by the square of the velocity of its movement.

The square plane consists of a frame of bar iron, bolted to the plank, with strong canvas, turned over and sewed to the upper bar of the frame, and laced by cords passing through holes in it, to the bottom bar and to those at the sides. The plank is a little more than three times the length of the frame, and is formed of three pieces, united by hinges at each side of the frame, with bolts over the hinges, so arranged that when the two outside pieces are opened up so as to be in a line with the middle piece, the bolts, being protruded, will keep them in that position; and when they are drawn back, will admit those pieces to be brought down by the sides of the frame, in order that the whole may take up less room in stowage, when not required for use. The chains connected by the ring in the middle, and drawn by the hawser, will pull the whole forward equally, without permitting one part of the frame to be acted on more than another by the resistance of the water. The dimensions of the frame are not mentioned, but from the length of the chains being eleven feet, it is supposed it could not be more than about seven feet long at each side.

This plan was first proposed by Dr. Franklin, who took the idea of it from a school-boy's kite, and had an apparatus for the purpose fitted up in the same manner, and very like one, an account of which may be seen in the Transactions of the American Philosophical Society.

INQUIRIES.

NO. 161.—PRINTING INK.

The most improved method of making Letter-press Printer's Ink? The Correspondent who communicates the best shall be presented with two guineas.—J. W.

NO. 162.—BEST SORT OF WALLS FOR FRUIT-GARDENS.

Sir,—Being settled in the South-West of England, and having built two walls to a garden at too much expense, I wish to ascertain, as stone is cheap here, whether a wall entirely of stone will properly retain the heat and ripen fruit? If the stones should be laid on flat or vertically? should the mortar be darkened, and the face of the wall also when finished? and does the darkness really absorb more of the sun's rays? Should it be coped or not, and what projection? There is a doubt as to coping being of use; Nicholl is against it. What thickness should the walls be at the base and top for an eight feet and six feet wall, and what foundation to each? Should the foundation be arched or not, so as to let the roots pass to the other side? Should wood be worked in or not, to nail to? What are the qualities of bricks to make them superior to stone? If bricks are really superior, will a facing of them (on edge) on the stone wall be sufficient? Walls wholly brick are too expensive for me, and I wish this infor-

mation before I attempt the other two walls to enclose my garden. It is the north and south walls I have to build. Simply, my questions lead to this, whether stone absorbs and retains as much and good heat as bricks? My object is profit by sale of fruit at our next market, more than beauty.

I remain, Sir,
A Constant Reader.

[We flatter ourselves that not many of our readers can be in any difficulty as to the answer to be given to this question; but as the writer (A Retired Shopkeeper) claims the privilege of an old subscriber, to have the opinions of his fellow-subscribers upon it, and offers, moreover, to give a premium of 2*l*. for the best essay upon it, we have thought it right to give it a place. It may occupy, usefully, a leisure hour of some of our Correspondents to furnish our friend with the information he desires.—Edit.]

No. 163.—Dissolving Indian Rubber.

Sir,—I shall be greatly obliged to any of your Correspondents who will inform me by what means Indian Rubber can be dissolved in naphtha. The directions given in the Annals of Philosophy for August, as taken from the Edinburgh Journal of Science,* are not sufficiently clear for that purpose. I have attempted the operation by digesting caoutchouc cut into small pieces in the naphtha, sold under the name of Gordon's fluid for lamps, having previously rectified it, and was much disappointed by the total failure of my experiment.

I am, Sir,
Yours respectfully,
Dyspepsia.

* The caoutchouc, after being cut into thin shreds, is steeped in the varnish composed of twelve ounces of caoutchouc to one wine glass full of the oil. Heat may be applied, and the thick varnish must be strained through a sieve of wire or horse-hair. The cloth is stretched on a frame, and then covered by means of a brush with a coat of the elastic varnish. When the varnish has become sticky, another piece of similar cloth, similarly varnished, is laid upon the first, the surfaces being placed face to face, and, to promote the adhesion, they are pressed between a pair of plain rollers, and then dried in a warm room. This cloth, of which we have now several very fine specimens before us, besides being used for outer garments, to keep off rain, will be found highly useful for various purposes in the arts and sciences.

No. 164.—Raising Water.

Sir,—Through the medium of your useful Magazine, I shall feel greatly obliged if any of your intelligent Correspondents will have the goodness to give a little information on the application of the steam-engine, or any other power now in use, for raising a certain quantity of water in a given time: the depth from which the water is intended to be raised is 33 yards, and the quantity 149,800 cubic feet in eighteen hours.—Required,

What power the engine,
diameter of cylinder,
length of stroke,
number of strokes per minute?
Pump—What diameter the barrel,
quantity of water per stroke?

I am, Sir,
Your obedient servant,
B——.

ANSWER TO INQUIRY.

No. 155.—Covering for Flat Roofs.

Sir,—For the information of "An Inquirer (No. 110, vol. iv. of your useful work), I beg leave to state that a cheap and permanent covering for a flat roof may be formed in the following manner:—Let the roof be covered with boards of any convenient thickness, slightly inclining towards one corner, for the better letting off water; then spread on, while warm, a composition of pitch with a little tar in it, carefully melted; over that lay (evenly) sheets of strong brown, or what is com-

monly called rope paper; then another layer of the composition, and again the paper, and so on alternately as often as may be deemed necessary, taking care to have a layer of the composition last, over which a small quantity of sand or very fine gravel should be sifted: the whole should then be kept covered (say, an inch or so thick) with gravel. A piece of sheet-lead may be fastened to the lower corner, and formed into a spout for carrying off the water.

The above method I can confidently recommend, having known it frequently adopted, and in every case answer the utmost expectation.

I remain, Sir,
Your obedient servant,
G. H. E.

Chesterfield.

NEW PATENTS.

To George Henry Lyne, of John-street, Blackfriars-road, mechanist and engineer, and Thomas Stainford, of the Grove, Great Guildford-street, Southwark, smith and engineer; for their invention of certain improvements in machinery for making bricks.—Sealed 23rd August—6 months.

William Parr, of Union-place, City-road, in the county of Middlesex, gentleman; for his invention of an improvement or improvements in the mode of propelling vessels. 27th Aug.—6 months.

To John Bowler, of Nelson-square, Blackfriars-road, in the county of Surrey; and Thomas Galon, of the Strand, in the county of Middlesex, hat-manufacturers; for their invention of certain improvements in the manufacture of hats. 27th August—6 months.

To Charles Mercy, of Edward-buildings, Stoke Newington, in the county of Middlesex, gentleman; for his invention of certain improvements in propelling vessels. 8th September—2 months.

To William Jefferies, of 46, London-street, Radcliffe-cross, in the parish of Radcliffe, in the county of Middlesex, brass-manufacturer; for his invention of a machine for impelling power without the aid of fire, water, or air. 15th September—6 months.

To Jean Antoine Teissier, of Tottenham-court-road, in the county of Middlesex, gentleman; in consequence of a communication made to him by a certain foreigner residing abroad, for certain improvements in steam-engines. 15th September—6 months.

To Cathcart Dempster, of Lawrence Pountney-hill, Cannon-street, in the city of London, gentleman; for his invention of patent cordage. 15th September—6 months.

To George Holworthy Palmer, of the Royal Mint, civil engineer; for his new invented machinery for propelling vessels through the water, to be effected by steam or any other power. 15th September—6 months.

To Adam Eve, of South, in the county of Lincoln, carpet-manufacturer; in consequence of a communication made to him by William Augustus Prince, a foreigner residing abroad, for certain improvements in manufacturing carpets, which he intends to denominate Prince's Patent Union Carpet. 15th September—6 months.

To Isaiah Lukens, late of Philadelphia, but now of Adam-street, Adelphi, in the county of Middlesex, machinist; for his new-invented surgical instrument, for destroying the stone in the bladder without cutting, which he denominates Lithontriptor. 15th Sept.—6 months.

To Sir Thomas Cochrane, knt. (commonly called Lord Cochrane), of Tunbridge Wells, in the county of Kent; for his invention of a new method of propelling ships, vessels, and boats at sea. 15th September—6 months.

To Charles Jacomb, of Basinghall-street, in the city of London, wool-broker; for his invention of certain improvements in the construction of furnace stoves, grates, or fire-places. 15th September—6 months.

TO CORRESPONDENTS.

We have had many inquiries for persons who can teach the drawing of machinery, and should be glad to forward the interests of any gentleman disposed to engage in this branch of instruction.

The point treated of by "Monitor" is one of considerable difficulty. We shall endeavour to give his and our own opinion upon it next week.

Communications have been received from W. C. H.—Aurum—T. M.—Vidi—A. B.—Ikey Pringle—J. R. M.—Q.—Justicia—Tyro—H. K.—A Builder—T. M. B.—Philo-Montis—T. N. P.—F. M.—A Miller.

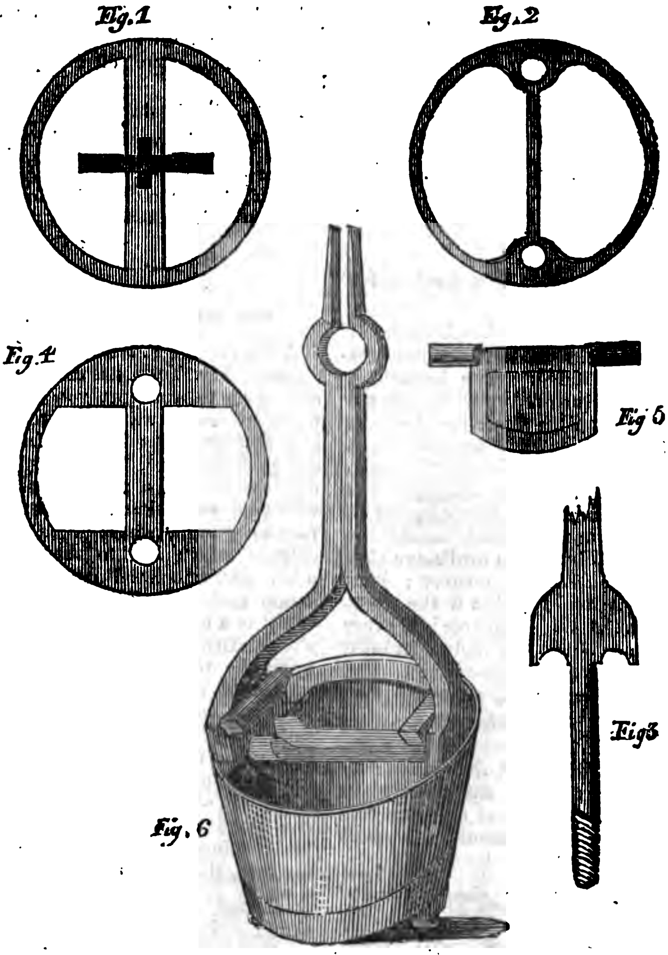
Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.
Printed by *Mills*, *Jowett*, and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

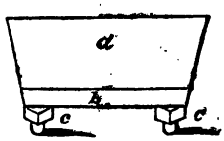
No. 114.] SATURDAY, OCTOBER 29, 1825. [Price 3d.

IMPROVED PUMP-BUCKET.



IMPROVED PUMP-BUCKET.

SIR,—Agreeably to the wish you were pleased to express in your 97th Number, I have the pleasure to present you herewith with a complete model of my improved Pump-bucket. The shell is of cast iron, the shanks or fork of wrought iron, and the doors or clacks of brass. The shell is clothed with leather in the usual way, and held on by an iron hoop at the bottom of the shell, which hoop is kept on its place by the washers and nuts at the fork ends, thus



a, The shell, covered with leather.

b, The iron hoop.

c, The nuts.

I greatly prize this bucket for three reasons.

1st. The entrance for the water is so clear and free, that the influx is much facilitated. The buckets I used before showed small obstructed entrances for the fluid; the shell was as thick of metal at the bottom as at the top, and so was also the partition, through which a dagger was put, which dagger was coupled to the rod and cottered under the bucket. Fig. 1 is a bird's-eye view of the bucket topsy-turvy: it is therefore evident, that if the working part of the pump-tree is at every stroke to be filled with fluid, it must enter at a very increased rate.

2ndly. The doors lie flat on the shell, and bed themselves down on every point, the longer they work, and the better joint they make: by taking off the nuts and pulling the fork out, you will at once perceive how very independently the doors act on their hinges.

3rdly. For the simplicity and strength of these buckets, especially for pumps of large capacity. Several years experience has convinced me of their superiority over all the other buckets I have ever tried.

Now, Mr. Editor, if you should judge this communication worthy a place in your truly valuable miscellany, I shall feel flattered by seeing it occupy a place in its pages, and remain, Sir,

Sincerely yours,

D——.

Warrington, August 6th, 1825.

Description.

Fig. 1, A bird's-eye view of my old bucket, when put topsy-turvy.

Fig. 2, The same of my present bucket.

Fig. 3, The shank.

Fig. 4, Bird's-eye view of the top.

Fig. 5, The door.

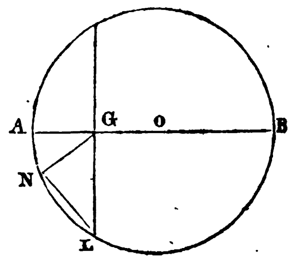
Fig. 6, A perspective view of the bucket when mounted.

NEW WATER-MACHINERY.

A Mr. George F. Reeve, of Orange County, New York, has constructed an engine to transport goods or articles by aid of water, where there is a sufficient quantity and fall for any given distance. Its leading principles consist of a wheel and axis, with float or buckets, adapted to a race or trough, whose angle of incidence is adapted to the fall, or other circumstantial conveniences. Upon each end of the axis of this wheel is a cog-wallow wheel, which works into a rack or cog plate, placed upon the top on each side of the race, and which answers for what may not improperly be termed a railway. The engine being situated at the foot of the race, the water is let in, and operating upon the floats, turns the wheel, and by the wallow cog-wheels of the axis of the water-wheel being geered with the rack on the race, the wheel ascends; and by a more or less partial supply of water, the water-wheel is made to descend with the velocity required.—*American Paper*.

USE OF THE SLIDING RULE.

Sir,—I am sorry that an omission of the letter G occurred (by me or you) in the diagram for producing polygons (Part xxvi., p. 296), which might cause some confusion to young beginners: it ought to have been inserted between A and O on the horizontal diameter A B.



Mr. R. H. endeavours to correct G. A. S. in his calculations on "The Use of the Sliding Rule." He asserts (Part xxvi., pages 308 and 309), "Suppose the lesser end to measure 6 inches square, and the greater 18 inches, and to taper regularly; then at the middle, the square, or quarter girt, will be 12 inches. Now the area of the square of 12 is 144, and the areas of the two extremes added together make 324, and divided, 162, being a surplus of 18 inches. So the piece, allowing it to be 12 feet long, according to G. A. S., would measure 12 feet; by what I consider the more correct method, 13½ feet nearly."

Mr. R. H.'s assumption is, that the areas of the two ends of a square tapering piece of timber (or frustrum of a pyramid) added together, and divided by 2, will give a mean area, for ascertaining the true content. Now this I think is not correct:

For the lesser end being $6 \times 6 = 36$, area lesser end,
greater $18 \times 18 = 324$, area greater end,

2)360

180

Mr. G. A. S.'s mean.........144.

36 inches surplus, and not 18, as Mr. R. H. supposes; and it will make his piece of timber to measure 15 feet nearly.

But the most correct method for finding the mean area that I have seen is as follows:—

To the areas of both ends add the product of the side of the square of each end; divide by 3, multiply by the length, and divide by 144.

Example as above.

$6 \times 6 = 36$ } areas of both ends,
$18 \times 18 = 324$ }
$6 \times 18 = 108$, product of the side of the square of each end,

3) 468

156, mean area,
12, length,

144) 1872 (13 feet, true content,
144

432
432

The same rule will apply to measuring round timber.

EXAMPLE.

Suppose a piece of round timber (or frustrum of a cone) 16 inches in diameter at the largest end, 8 inches at the smallest, and 12 feet long; what is the content?

$$\begin{array}{r}
8 \times 8 \times 7854 = 50,2656 \\
16 \times 16 \times 7854 = 201,0624 \\
8 \times 16 \times 7854 = 100,5312 \\
\hline
3)\ 351,8592 \\
\hline
117,2864 \\
12 = \text{length}, \\
\hline
144)\ 1407,4368\ (9,77 = 9\tfrac{3}{4} \text{ feet nearly.}
\end{array}$$

N.B. If you extract the square root of the mean area, it will be the side of the square (or quarter girt), by which you can measure the piece with the slide rule.

For example, $\sqrt{156} = 12\tfrac{1}{2}$ inches nearly.

Mean areas.. $\sqrt{117,2864} = 10\tfrac{3}{4}+$

Set 12 feet (the length) on C to 12 on D, then against $12\tfrac{1}{2}$ inches on D stands 13 feet, the content on C.

Again, set 12 feet (the length) on C to 12 on D, and against $10\tfrac{3}{4}$ on D stands $9\tfrac{3}{4}$ feet, the content on C.

I am, Sir,

Yours respectfully,

C— K—.

Pembroke Dock,
September 21st, 1825.

MECHANICS' INSTITUTION AT DEPTFORD.

On Tuesday, the 18th of October, a numerous Meeting of the Mechanics of Deptford was held at the Roman Eagle, for the purpose of establishing a Mechanics' Institution in that town. At eight o'clock the chair was taken by Dr. Olinthus Gregory, who has consented to become the President of the Society.

After a brief exordium, the PRESIDENT addressed the Meeting as follows:

"You must prepare yourselves for opposition. There is not, in the whole range of human undertakings, one that has not had to contend with some species of enemy; and it is only until you have overcome every difficulty, and stand upon your own firm and proud pre-eminence, that you must expect your labours to go on quietly. I do not mean to say that this opposition will, in all cases, proceed from persons of bad intentions, but from those who really do not take the trouble to understand the object you have in view. I remember when poor children, 20 or 30 years ago, were first taught the simple art of penmanship, it was urged—'Oh! you must not teach them to write, or they may commit forgery.'—(A laugh.)—Now, let us see how far this kind of reasoning will carry us. You must not teach children to speak, or they may commit perjury. Again, suppose my excellent friend Dr. Birkbeck to be called upon to attend a person labouring under a paralytic attack, it might be said, 'Oh, don't do any thing for him, let him remain as he is, or who knows but that in a week or two he may commit an assault.'—(A laugh.)—The general questions are—'How far do you intend to go?—What do you purpose by your Mechanics' Institutes? You have your National Schools, your Lancasterian Schools, your Sunday Schools, and now, forsooth, you must have your Schools of Science.' Gentlemen, I will tell you how far we intend to go—to the very extent of your mental susceptibilities. It is said, that immediately you are instructed in science you become unfitted for the practical arts; as if the improving of your heads would lessen the skilfulness of your fingers. I contend, from actual observation, that the contrary is the fact. Will a man, because he may be told that Queen Elizabeth reigned after William the Conqueror, make the worse journeyman blacksmith? Because he may be instructed in geography, and learn that the Cape of Good Hope is in Africa, and Cape Horn in South America, will he make the worse locksmith? Because he may be told the elements of which water is composed, will he make the worse shipwright, husband, father, or son? I have, within my own ken, and even within my own eye at this

moment, men, who, filling an humble situation in life, are persons whose talents and mental industry render them objects of my admiration. I know an individual residing at Woolwich, an aged man, who has weathered the storms of seventy winters, and never, I believe, at any period of his life, earned above thirty shillings per week, and yet science is considerably indebted to the genius and assiduity of that venerable person. He has, among many other improvements, invented a composition pendulum, the service of which is well known to, and duly appreciated by, by my friend, Dr. Birkbeck, and others around me. Now, I will venture to say, that the individual of whom I am speaking has quite as much industry, and is equally fitted for the occupation by which he gains his livelihood, as if he were perfectly innocent of the talent which I have told you he possesses. I have now to inform you, that several Gentlemen, who are eminent in science, have kindly offered their assistance in occasionally delivering lectures to you. But it is not upon lectures that you are altogether to depend for the information you seek. Much is to be done—much must be done by yourselves, by conversation, by mutual interrogation, and by assembling in groups, and demonstrating to each other the truths with which one may have been enabled to become more readily acquainted than another: and here let me remark, that the most important principles may be exhibited by very simple apparatus—for instance, the principle of the lever may be shown by a foot-rule and some penny-pieces; and by the means of a spring steel-yard, and models of the beams of a house or ship, the precise strain which these beams will bear may be ascertained. There is not, perhaps, one among you, who does not know that, in laying the rafters for a floor, they are so placed that their depth may exceed their breadth. And this, which may appear to some of you the result of custom, is not so, but the consequence of a knowledge of one of the fixed laws of nature—namely, that in any beam the breadth multiplied by the square of the depth, divided by the length, will represent the strength. Why, then, should not the labouring carpenter be made acquainted with these laws? Why should not the plumber be instructed in the science of hydraulics? Improvements are far more likely to be suggested to those engaged in the practical application of a science to the useful purposes of life, than to those whose attention is devoted to its theory. I know of several improvements that have been made in an engine in Woolwich-yard by the persons engaged in the labour of working it. There are, besides, other advantages resulting from the knowledge of science. Opportunities will sometimes occur when that knowledge will be of the utmost possible consequence. I will mention two cases bearing upon this declaration. Two young men, neither of whom could swim, were about to bathe in a place where the water did not appear above four feet deep. One of them, however, who had studied a little of optics, and knew that the rays of light refracted from water, that is, in passing from a denser to a rarer medium, would become bent, and consequently elevate the bed of the river, cautioned his companion to stop, just as he was on the point of plunging into the stream. This probably saved the young man's life, for it was subsequently ascertained that the water was above six feet deep. The second is an instance of the life of a sailor being saved through the scientific knowledge of a cabin-boy: this lad had read in some book, that the specific gravity of the whole of a man's body was to a similar bulk of sea water as nine is to ten, and consequently that it must float upon its surface; but the man kept lifting his arms above the water, which the lad saw would counterbalance the less specific gravity of the remainder of the body; he therefore kept calling to the sailor, 'Keep your arms down!' This advice was attended to for more than twenty minutes, and the poor fellow's life was eventually saved. Gentlemen, this poor cabin-boy was no less an individual than the subsequently eminent Mr. Nicholson, editor of the Philosophical Journal, who, in connexion with Dr. Birkbeck, first gave that impulse to the mechanics which is now felt at the remotest parts of the kingdom. Here, then, is a striking instance of a man bursting from obscurity—of genius shaking off the trammels that bound it, and springing into new life and freedom. You all know, Gentlemen, what the poet says—

'Full many a gem of purest ray serene
'The dark unfathom'd caves of ocean bear;
'Full many a flow'r is born to blush unseen,
'And waste its sweetness on the desert air.'

Is it not possible, then, that there may be many such a gem here—that there may be in this room the bud of many such a flower? What was Sir Richard Arkwright, a man to whose genius this country is indebted for very much of its commercial prosperity—to whose improvements in the machinery for spinning cotton we are indebted for being enabled to keep the cotton trade chiefly confined to ourselves—what, I say, was the great Arkwright? A barber. Yet we owe our proud superiority in this department of our national greatness to the unassisted efforts of Dick the barber. Who was Ferguson? A simple peasant, a man who, wrapped in his plaid, passed the winter nights in contemplating the heavens, and who, by arranging his beads upon the cold heath, at length completed a map of the stars. Who was Dr. Herschel, the discoverer of so many important astronomical facts? A boy who played the pipe and tabor in a foreign regimental band. Who was Watt? A mathematical instrument-maker. Who was Smeaton? An attorney. Who was Brindley, whose canals have given such an accession of power to our commerce by the facilities of internal communication? A millwright. Nicholson, a cabin boy; and Ramadge, the best maker of reflecting telescopes in the world, a Scotch cutler. Now, without labour, without perseverance, without science, Sir R. Arkwright would have remained Dick Arkwright the barber—the great Herschel would have piped on to the end of the chapter—Watt would have made spectacles—and all the others would have continued in that obscurity from which they emerged with such astonishing brilliance. And what is it that renders us fit to be raised into such distinction? Why, our being Englishmen. From the cow-boy up to the throne, there is not an individual who does not enjoy the higher elevation for being an Englishman. What is it that makes George the Fourth the greatest Monarch in the world? Not his splendour, nor his army, nor his navy; but that he reigns over the most free, the most intelligent, the most inquisitive, the most virtuous people on the face of the earth."

The Learned President sat down amid most cordial cheering.

Dr. Birkbeck then rose, and explained to the members the duties they would have to perform. He traced the progress of the Mechanics' Institutions from their rise in Glasgow, and proceeded, at great length, to argue upon their necessity and usefulness, bringing his arguments home to the parties he was addressing, and concluded with expressing his sincerest hope that the gates of knowledge would soon be as open as the gates of mercy.

Several donations were then announced, and the meeting dispersed.

BAKING MACHINERY.

Sir,—In your Magazine for April I endeavoured to direct the attention of some of your ingenious correspondents to the necessity and importance of introducing machinery into bakeries, to preclude the very objectionable mode adopted in the present process of manufacturing bread—a process in the operation of which cleanliness and neatness are so entirely disregarded, the implements of operation being alternately and promiscuously used in mixing the "sponge," incorporating the "liquors" and "material," kneading the dough, and using the fire-rakes, stokers, cleansers of the ovens, and other apparatus about the furnaces, as well as sundry other articles, utensils, &c. of the bakery, which tend to soil the hands. When I solicited a place in your very useful Magazine for the essay on this subject, I expected that the inventive genius of some of your numerous Correspondents (so eminently distinguished for fertility of invention, and skill and judgment in its practical application) would have produced something worthy of them and the important matter to which their attention was directed; but I am astonished to find that the subject, all-important as it is, has produced no effect whatever to meet the occasion, save and except one solitary attempt made by your Correspondent G— J— in your Magazine of the 11th of June, in which he gives a decription of what he denominates a kneading-machine, illustrated by an engraving, and which he says has been used in the public baking-houses of Genoa, but which I affirm to be as inapplicable to the purpose of "kneading" dough as any ill-adapted machine could be, inasmuch as no revolving

power working horizontally could move in so dense and compact a mass as dough would present when in a state to be kneaded. This circumstance, conjoined with the vast expense of such a structure as his drawing represents, would entirely forbid the use of such a machine. In respect, again, to the plan of Mr. Joseph Baker, to which he refers in the same paper, and for which he says a patent was obtained, I will only observe, that I am of opinion that that plan is so very inadequate to the purpose (although more properly a kneading-machine than the other), that no one will regret the protection which the patent gives it against being brought into general use. It is objectionable on several accounts, and only fit at all to be used by biscuit-bakers, whose dense and indurated mass of dough requires more than ordinary pressure. But it is not merely for the purpose of kneading dough that machinery or suitable apparatus is necessary in the bakery: other parts of the business require it as much. The workmen's naked hands and arms are the implements now used in mixing the "sponge" and incorporating the "material" at a period when (on some occasions) there is, perhaps, not the greatest inclination to cleanliness; and this circumstance should make us solicitous to adopt some other mode of practice in the manufacture of an article of such indispensable and general use. The essay of A. B. C. also embraced other important points on this subject, claiming largely the efforts of ingenuity and invention, and it is not likely but that, in a country that has given birth to such brilliant geniuses that now adorn it, something may be elicited favourable to this object.

I remain, Sir,

Your obedient servant,

A. B. C.

Cork, 30th August, 1825.

COMPLAINT OF JUSTITIA.

Sir,—My name is Justitia, and I am, in the moral, precisely what the centre of gravity is in the mechanical and material world. Presiding over these affairs, and taking very great delight in the mechanical department of my dominions, I am not a little displeased (particularly in the present mechanical era) to find myself placed in effigy over the portals of the "Norwich Union Fire and Life Insurance Office," as pretending to administer justice to those who enter its doors, by displaying the following unjustifiable mechanical blunder. They have represented me, Sir, as holding a steelyard in my hand, with the sustaining fulcrum outside of the weight!

Now, Sir, to pacify my disturbed mechanical feeling, and the feelings of those who may have noticed the same thing on passing down on the left-hand side of Bridge-street, as well as for the *appearance* of the equitable intention of the Directors, and also to appease the manes of our old friend Archimedes (for, Sir, there have been lately supernatural appearances not far from that spot), I do hope that the *injustice* which has been *offered* to me (and which, in effigy, I had not power to reject, or I should have spurned the artist to the ground), will, upon my thus publicly complaining, be as publicly adjusted.

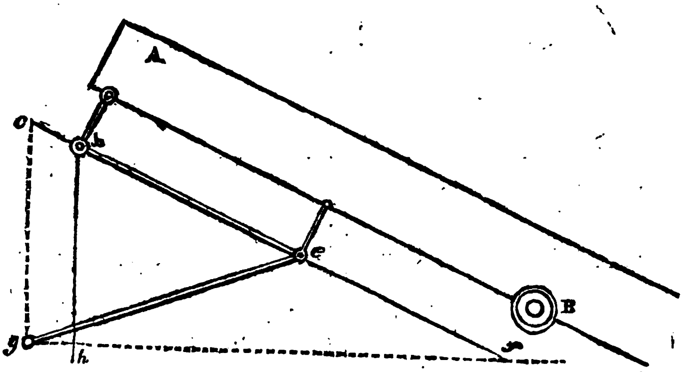
I am, Sir, your sincere friend, and taking great interest in the continued success of your work,

Justitia.

MACHINE FOR DIGGING POTATOES.

Mr. Michael Barry, of Swords, has invented a machine, simple in its construction and principle, by which, with two horses and one attendant, an acre of potatoes can be dug out in one hour: also, an acre of ground, previously ploughed for oats or other grain, can be harrowed by it in an hour with two horses and one attendant, thereby effecting, in the branch of harrowing, a saving of upwards of 93 per cent.; or, in other words, doing the work of 32 horses and 16 attendants with two horses and one attendant.

PARALLEL MOTION.



SIR—Somewhere, I think, in your first volume, I saw a request for information respecting the manner of constructing a Parallel Motion, which I do not find answered; and as I have known many, both theoretical and practical engineers, desirous of information on the same subject, it first suggested the thought of making you this communication.

How to construct a Parallel Motion.

Let AB be part of the main beam standing at the upper extremity of the stroke; *d*, the end or cap of the piston rod; *h*, the same at half stroke; *dh*, the line in which it is intended to move; draw *hg* perpendicular to *dh*, and let *g* be the fixed end of the radius bar, which should be taken as near to *h* as possible; through *d* draw *de*, parallel to the beam, AB, and meeting *gh*, produced in *f*; in *fd* produced take *dc* equal to *hg*, and join *gc*; draw *ge*, making the angle *egc* equal to *ecg*, and cutting *fc* in *e*; then will *ge* be the radius bar, and *de* the parallel bar of the required parallel motion.

Otherwise, by means of a Table of Natural Sines.

Multiply the sine of the angle, *gfd*, by half the length of the stroke, and to the product add the distance, *hg*, multiplied by the versed sine of the same angle. By the number thus found, divide half the square of half the stroke; the quotient will be the length of the parallel bar, to which add the distance, *hg*, will give the length of the radius bar.

EXAMPLE.—Let the length of the half-beam, AB, be 10 feet, half stroke 4 feet, *hg* 1 foot; then will the sine of the angle of elevation of the beam be .4, and its versed sine .0835

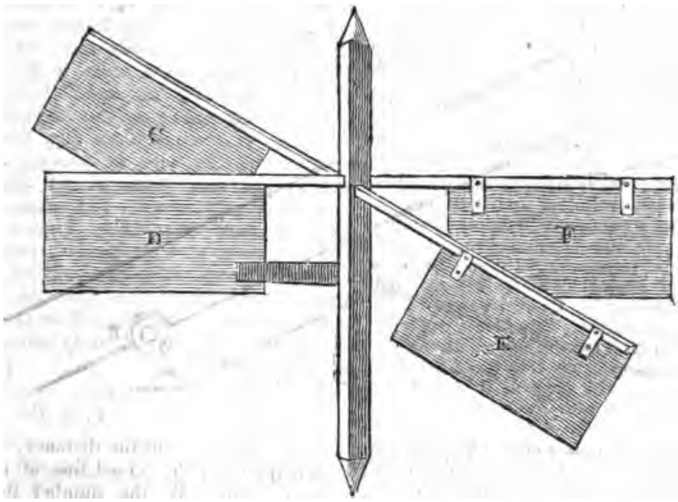
And, $\overline{.4\times4}+\overline{1\times.0835}=1.6835$

Also, $\frac{4^2}{2} \div 1.6835 = 4.752$, &c.

equal 4¾ feet nearly, the length of the parallel bar; whence the radius bars equal 5 feet 9 inches.

N.B. The sine and versed sine may be easily found without a table: thus, divide the half-stroke by the half-beam; the quotient is the sine, as $\frac{4}{10}=.4=$sine of elevation. And if we subtract the square of the sine from 1, and subtract the square root of the remainder again from 1, we shall have the versed sine. Thus, $1-\sqrt{1-.4^2}=1-\sqrt{1-.16}=.0835$, the versed sine.

HORIZONTAL WIND-MILL.



Sir,—Perhaps the following simple method of constructing a Horizontal Wind-Mill, may be acceptable to some of your numerous mechanical readers.

I am, Sir, yours, &c.

T. T.

Description.

AB is an upright shaft, into which the four arms are inserted at right angles. The sails, CDEF, are formed of some light substance (in my model of pasteboard), and fixed to the arms by joints, so as swing freely one way, but are prevented swinging in the opposite direction by a stop placed behind each, as at G. Now, when the wind blows upon the sails, in any direction, suppose upon DF, the sail, F, being prevented from swinging upon its joints by the stop in the back-part of it, the wind will, of course, drive it forward; while the sail D, whose stop is on the opposite side to that of F, will rise, and permit the wind to pass freely under it, and the desired motion will be produced. Perhaps six or more arms, placed so as the wind might act upon as many as possible at the same time, would, in this case, be preferable to four.

It need scarcely be observed, that the greater the extension of the arms from the vertical shaft, the greater the power of the machine.

THE AIR AND WATER ENGINE.

Sir,—Permit a juvenile reader of your valuable publication to offer a few remarks upon a subject in your 104th Number, which appears to be totally erroneous.

In page 317 and 318, of vol. iv. of the Mechanics' Magazine, there is a description of an Air and Water Engine, described by a member of the Bolton Mechanics' Institute. Now, if I understand his meaning, when he puts his engine in motion, the water in the first cylinder, A, descends down the pipe, C, forming a vacuum in the cylinder, A, and the air pressing upon the piston, H, forces it down to R, while, at the same time, the piston, K, is being raised, and the cylinder, B, being filled from the cistern (not shown in the drawing), L. When full, the water in the cylinder, B, descends through the pipe, D, and forming a vacuum under the piston, K, the atmosphere presses upon the piston, K, and *vice versa*. Now, to say that this engine would not work where there is a fall of

water 34 feet perpendicular, would be absurd; but I would ask your Bolton Correspondent, whether it would not be better to apply this fall of water upon the rim of a water-wheel, and consequently put aside the friction of the air-tight pistons, and the opening and shutting of the valves, and reduce it at once to the friction of the fulcrum of a water-wheel?

On perusing a little farther, we find our Correspondent beginning to work miracles. He is going to make a four-horse power Bolton and Watt engine raise enough of water to supply an eight-horse air and water engine, which I conceive impossible. I should like this Bolton genius to make his air and water engine lift its own water. If he can once do this, he will assuredly be the cleverest man in the whole world.

To demonstrate this powerful machine, we will suppose it in motion, well supplied with water from some reservoir, and his pistons moving over 220 feet per minute each; it is evident that a column of water, equal in area to the pistons, must descend down the pipes at the same velocity, or 220 feet per minute. Now, we will suppose the communication with the reservoir cut off, and a Bolton and Watt engine erected, to supply the air and water engine; it is evident, again, that as much water must be raised by the steam-engine as descends through the air and water engine; and as the water exerts no more than its own gravity on the air and water engine, it is plain that the engine that would supply this air and water engine with water, would be more powerful than the air and water engine itself.

To answer, therefore, the questions proposed by our Correspondent would be useless.

If I have fallen into any errors, I shall feel obliged to any of your numerous Correspondents to detect them; but if I am right in my suggestion, I hope they will convince your Bolton Correspondent of his error.

I remain, Sir,

Yours in sincerity,

J. P. Steam.

[We shall be glad to receive the other communications proffered by our Correspondent.]

VIATOR'S PERPETUAL PUMP.

Sir,—In Number 100 of your Magazine, both Montis, Jun. and V. H. have pointed out such an objection to Viator's Perpetual Pump, as renders it perfectly inefficient for its purposes. It will be a very valuable communication (because I know nothing that may be made more extensively useful than such a machine), if Montis, Jun. and R. Crusoe would have the goodness to give drawings of the machines they describe; and also, with the drawings, specify the dimensions of all the parts of the machines. The dimensions of each part being known, and the power of a machine of such and such dimensions being also given, would enable those who can command small streams of water to apply them to very extensively beneficent purposes.

I am, Sir, yours, &c.

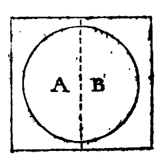
T. N. P.

Worcester.

We are happy to have already in our possession the following paper from Montis, Jun., which supplies, in part, the information requested by T. N. P.

Sir,—You did me the favour to insert, in your 100th Number, my opinion (for I acknowledge I have not tried the experiment) with respect to Viator's Perpetual Pump, in Number 93, wherein I stated, should you deem the same worthy of notice, that I would, in a future communication, describe the sort of valve that would render such an apparatus a perpetual pump; which pledge I now beg leave to redeem.

The valve which I conceive best adapted, would be one placed in the bottom of the trough, turning upon an axis running across the centre, thus—



and equal to, say one-half, of the bottom of the triangle; indeed, the whole bottom might be converted to this purpose. The rim of the side,

A, of the valve, would shut upon a narrow ledge on the *under* part of the trough; and the other side, B, would rest upon the *upper* or inner side of the trough; as the axle, from being in the centre, would equally divide the pressure of water, it would retain its horizontal position until forced out of it. The machine having been set to work, and the stream having, say very nearly, filled the trough, it would descend. A stake being placed underneath, in a situation in which the right side, B, of the valve, would come upon it, the weight of the trough full of water would instantly force it open, and the valve being now in a perpendicular position, the water would rapidly run out; the trough would then ascend, and the valve being so placed, that the stream, when the trough had regained its first position, would fall angularly upon the upper side of the valve, it would shut it, and the same operation, as before, be repeated. If the axle were made *square*, it would ensure the valve always fixing itself in the directly perpendicular and horizontal positions. In a practical point of view, there is, however, the usual objection here against valves, viz. their liability to get foul; but my object has rather been the principle than the practice.

I am, Sir,
Your most obedient servant,
MONTIS, Jun.

MANUFACTURING ICE.

An apothecary of Caen, in Normandy, has just discovered a method of procuring ice at all seasons of the year, by mixing four pounds of sulphuric acid (oil of vitriol), 36 deg. with five pounds of sulphate of soda (Glauber salts, in powder). This mixture must be made in an earthenware or china vessel, and the water which it is wished to congeal must be put in it in a separate vessel wrapped round with flannel, cotton, thick paper, or some other non-conductor of heat, and the operation must be repeated three times on the same body of water.

WATCH AND CLOCK MAKING.

SIR,—Mr. Berthaud's work on Watch and Clock Making, in French, having lately fallen into my hands, I find therein a number of manuscript annotations, made by its former possessor, who appears to have been a very scientific watchmaker. As many of these may be extremely interesting to the trade, if you think them worthy of a place in your valuable miscellany, I shall continue to supply a portion of them, from time to time. I shall send you a literal copy of the original, as, in altering the diction, it might not be so plainly understood by the practical workman.

I am, Sir,
Your humble servant,
B. P. C.

Thirza-place, Kent-road.

"Having had great opportunities of acquainting myself with the practice of clock and watch making, a business to which I was always much inclined from my infancy, I have thought to put my remarks together, as I find it essential to employ my mind in confinement,* and I flatter myself, also by being useful hereafter, though to those unknown.

"I should not have thought on this subject, had I not found the generality of workmen in this business such strangers to the principles on which they work, though there are many who are excellent in handling.

"In the year 1714, the Rev. Wm. Derham, D.D., was engaged in similar amusement: at that time the art was not so well understood, but his little book, which is by me, was well received, and is still esteemed by many, though exceedingly deficient for our time. The world will be surprised to hear, that before Dr. Flamstead (about 1700) was astronomer, no person knew what o'clock it was correctly. He formed the first equation tables. Mr. ——, a Scotsman, also published a work: he writes most like a man of science,

* I am informed he was confined to his bed a long time through illness.

but his language was too short and pettish. The Duke of Argyle was his friend. King George the Third gave him 1000*l.* for a clock with compound pallets; but in the Royal Observatory they use Graham's dead beat, improved by steel swing wheels and oriental agate pallets. The Encyclopædia Britannica says, none are better. The Duke first used a wooden pendulum rod for astronomy. In 1786, Frederick Berthaud published "Essai sur l'Horlogerie," 2 vols. quarto, at Paris. The language is too prolix by half; there are 38 well-engraved copper-plates; and much is said of equation clocks, and there are many curious plans for that purpose, but of no use when executed. He values much his bastard scapement, between dead and recoil, as not effected by doubling the weight, which he calls *Isochrone* scapement; he seems to know nothing of agate pallets and steel swing-wheels in clocks, or even jewellery in watches. He made a timepiece for the longitude, to be screwed to the deck, over head each balance, for there are two, three French pounds weight;* the whole machine three feet long. He jewelled the pivot-holes of the verge himself, which shows there were no watch-jewellers in Paris. I have seen a great number of French watches, but never saw one jewelled, neither have I ever found a workman who had seen one; but lately I am informed they have a watch-jeweller at Paris: their practice is brass pivot-holes, cocked with hard steel or agate, at the cock and pottance foot. However, Berthaud's books are of use; and perhaps he is the only author who has entered into the working part; describing forging, filing, turning, soldering, polishing, gilding, enamelling, spring-making, &c. From him I gained computation, but I found a dividing table necessary, which he had not. He made very expensive experiments on expansion, some of which were ridiculous, such as gilding an iron bar, to try if it would prevent expansion. He erected on its end a block of marble, five feet high, one foot wide, and five inches thick; near the top was screwed through the marble a stud of metal, 2½ inches in diameter; this stud had the end slit, that a pendulum might hang; about two inches from the marble was a neat box and door; the stud fixed in the marble then passed through a hole in the box, so the pendulum hung in the box; behind the box was a plank, about half-way between the box and marble. To keep the marble cold, there was a second stud screwed into the marble, passing in the same manner into the case; about pendulum length below, at the bottom of the case, was an iron box filled with turf, to communicate heat to the case by pipes passing through it. A thermometer was placed in the case. To the lower stud spoken of above, a half-circular piece of brass plate was screwed, having a pivot-hole in the centre for the pivot of an arbor, cocked, which carries an index and a pinion of 16 teeth; this pinion works in a rack of 4-inch radius, 12 teeth, of 396 = circumference, to line of expansion = 180 of index. I think this is description enough for a workman to understand this pyrometer.

(To be continued.)

* Observe, 36.7 French inches are equal to 39.2 English.

CHEAP AROMATIC VINEGAR FOR PURIFYING LARGE BUILDINGS, MANUFACTORIES, ETC.

Take of common vinegar any quantity, mix a sufficient quantity of powdered chalk or common whiting with it, as long as bubbles of carbonic acid gas arise. Let the white matter subside, and pour off the insipid supernatant liquor; afterwards let the white powder be dried either in the open air or by a fire. When dry, pour upon it, in a glass or stone vessel, sulphuric acid as long as white acid fumes continue to ascend. This product is similar to the acetic acid known in the shops by the name of aromatic vinegar.

TO CURE SMOKEY CHIMNEYS.

To prevent chimneys smoking, in building a chimney, contract the vent as soon as possible, then gradually widen it for four or five feet, and then contract it to the usual dimensions, and carry it up in any direction. It is said, that a bladder suspended to a cross-bar, four or five feet in the chimney, will also radically cure this nuisance.

EXPERIMENTS RESPECTING THE DRY ROT.

Sir,—Many communications have been made to your valuable Magazine respecting the nature of Dry Rot in Timber, and much has been written and published on the subject, during many years, without any correction of the evil being afforded, and, it is to be regretted, without any success in asserting the real cause of it.

Moisture has been more frequently assigned as the cause than any other, and correction, under that impression, has been advised; but, of course, uselessly, as regards the bulwarks so peculiarly important to our islands.

I shall, therefore, trust to be able to show, that moisture is not the *immediate* cause of dry rot: and I could wish, in the second place, to show the method of preserving timber; but every means I have as yet applied have only slightly retarded it, and I fear, on a large scale, they would not be found of sufficient value for adoption.

All writers have agreed, that dry rot, wet rot, or blue fungus, which is common to all vegetable matter in a state of putrefaction, are of similar character.

I have ascertained, that pieces of the soundest and best-seasoned oak and fir, floating in water, containing a slight infusion of galls, become mouldy in about four or five days; that in water, slightly acidulated with sulphuric acid, a longer time is necessary to procure mouldiness; that in three weeks similar timber was mouldy, though floating in a solution of alum; that solutions of soap, lime, and potash, afford no better protection; and I doubt whether the sulphate of iron, and sulphate of zinc, served better; at the same time they certainly appeared rather to defer the formation of mould for five or six weeks, which may have arisen from accident in the evaporation, from great strength of the solution, or other causes.

Leather, prepared by the infusion of galls, every one must have experienced, becomes mouldy in a very few days in a moist atmosphere; and I have tried many substances in solution, in which the infusion of galls scarcely failed to produce mould or fungus, as in black ink, &c.

That the very best-seasoned oak contains the matter for forming an infusion of galls, is proved by a solution of iron being invariably rendered black, as the holes made by iron nails become black; and near every oak tree, which is hewn, pools of water are found of the same colour. Good yellow deal appears to be much less disposed to rot and become mouldy, but, like all other vegetable matter, requires moisture alone to allow its acid (I presume the acetic) sufficient action to cause putrefaction.

From these experiments I presume there cannot be the least doubt that sap, or the property of the gall-nut, causes this evil in the oak with the greatest readiness; and that, therefore, as has been before observed in your publication, if timber be cut in the spring, at which time gall-apples are formed, it must be particularly liable to rot and mouldiness, as the juices are then proved to be the most abundantly distributed.

Having thus ascertained the *immediate* cause of the putrefactive process, and the most ready mode of producing it, it will be perceived that I endeavoured to learn what appeared to afford some mode of correction; and, thirdly, by the application of different ingredients, to close the pores, and render the timber unpermeable, and ships more

wholesome and dry, by preventing the transmission of water from without, and evaporation from within.

Coal tar, oil paint, preparations of rosin, &c. have been applied to ships and boats; and they would produce good effect, were it possible, by such means, to render timber wholly water-proof; but as they evidently fail to effect that, they increase the evil; for if moisture must enter the timber, the opposite remedy is the most efficient, that of allowing no stagnant liquid, but free egress and constant evaporation, so as, at least, to keep the timber as dry as possible, and the injurious infusion as *little concentrated*.

Ships now building, we are informed, are protected from dry rot during that time by roofs; it therefore seems clear, that correction of dry rot can take place from three sources—the extraction of gallic or acetic acid in timber, neutralizing its action; or, thirdly, rendering the timber utterly unpermeable to moisture and air.

It must be advantageous to cut timber in winter; but upon the sources for cure, it can be necessary only to observe, the first may perhaps be effected by severe drying, and the second, by treating with alkaline matter, metallic antisceptics, or by weakening the injurious matter, and alternately wetting and *quickly* drying.

The last mode has been attempted in all ages, but it has been found wholly impossible to render the wood entirely proof against the admission of water, in consequence of the pressure, friction, constant attack from moisture, and evaporation, always taking place from within a boat or vessel to a great extent; and I doubt whether the mud, barnacles, &c. forming on a ship's bottom, "too much defended" by Sir Humphry Davy's protectors, do not adhere from this cause; the copper is acting continually as a strainer, and, if I may be excused, I doubt whether copper could be "too much defended" against corrosion, but for this straining process, which causes the impurities and insoluble matter in water to form at the bottom of all vessels which have a *permanent* surface.

I am, Sir,
Your very obedient servant,
TYRO.

London.

GRINDING INDIGO.

SIR,—The plan of Grinding Indigo now in general practice, is to soak, and then, with a considerable quantity of water, put it into a cast iron pot, in which are two large cast iron balls, which are propelled by mechanical means. This method is so very tedious, that oftentimes one quantity of indigo will take more than a week to grind; and the hard flinty sorts by this means are so very imperfectly ground, that a considerable loss is sustained thereby to the dyer, as the blue vat will not take up any that is not completely pulverized, and will form a sort of creaming liquid with the water, and in which, upon rubbing between the fingers, not the smallest particle of grit can be felt. A quicker and better method being extremely desirable, I shall fell obliged if any of your numerous Correspondents will, through the medium of your useful Magazine, furnish me with the plan of such an one; by so doing he will render the blue-dyers a most essential service.

I remain, Sir,
Your obedient servant,
BLUE VAT.

Bowbridge.

INDIAN RUBBER TUBES.

At a Meeting of the Nottingham Literary and Scientific Society, held on Monday, the 10th instant, a paper, by Mr. H. B. Leeson, describing an improved process of manufacturing Tubes and other Articles from Indian rubber, was read, and some tubes so prepared were handed round, for the inspection of the members.

After pointing out, that all the present processes of manufacturing elastic gum were objectionable, either from the injury they occasion to its

elastic properties, or the great expense of the menstrua employed (such, for instance, as cajeput oil and ether), the writer proceeded to detail his process.

A bottle of Indian rubber, previously softened by boiling in water, as described by Mr. Leeson, in his paper on the self-acting blow-pipe, inserted in the 17th volume of the Quarterly Journal of Science and Arts, is first to be distended to the utmost possible extent, by means of a condensing syringe. The rubber thus expanded into an uniformly thin layer, is then cut into stripes of the breadth of one or two inches, and wrapped longitudinally round polished iron rods, of the same diameter as the bore of the tubes required. The rod has a hole through each end, and a tape being made fast to one hole, it is tightly wrapped, in a spiral manner, over the layer of elastic gum previously applied. The whole is then boiled in water for several hours; and if, when taken out, perfect adhesion has not taken place, it is again wrapped with fresh dry tape, and reboiled until the union is complete. The roughness left upon the external surface of the tube may afterwards be removed, by binding it with a smooth plate of metal, and boiling it over again. The tubes exhibited to the society were in nowise to be distinguished, in their elasticity, from the bottles met with in commerce, and afforded convincing evidence of the excellence of the process.

EXTRAORDINARY RISE OF THE RIO DE LA PLATA.

This river, as is well known, is flooded at certain periods, and, like the Nile, inundates and fertilizes the country. The Indians then leave their huts and betake themselves to their canoes, in which they float about until the waters have retired. In April, 1793, it happened that a violent wind had heaped up the immense mass of waters of this river to a distance of ten leagues, so that the whole country was submersed, and the bed of the river remained dry, in such a manner that it might be walked over with dry feet. The vessels which had foundered and sunk were all exposed again, and there was found, among others, an English vessel which had perished in 1762. Many people descended into this bed, visited and spoiled the vessels thus laid dry, and returned with their pockets filled with silver and other precious articles which had been buried more than thirty years in the deep. This phenomenon lasted three days, at the expiration of which the wind abated, and the waters returned with fury into their natural bed.

ANSWER TO INQUIRY.

NO. 150.—THE SACCHAROMETER.

Sir,—Your Correspondent, Bung, requests to know, after having found the density of a body by the Saccharometer, how he is to proceed to find the specific gravity. Saccharometers of modern date, especially those made by Dring and Fage, are accompanied by a sliding rule, which shows you (after having found the density) at a glance the specific gravity of any body, from water to 1164; but as your Correspondent does not appear to have seen one, I will show him the readiest method, with the pen, that I am acquainted with.

Having found by a saccharometer the density of a body to be 50lbs., you are by it to understand, that a barrel of wort, &c. containing 36 standard ale gallons, of 282 cubic inches each, is 50lbs. heavier than a like quantity of water (specific gravity 1000); therefore the quantity of cubic feet contained in a barrel (expressed in decimals) is 5.875. First, reduce the number of pounds density into ounces; then divide them by 5.875; add the product to 1000, and you will have the specific gravity required.

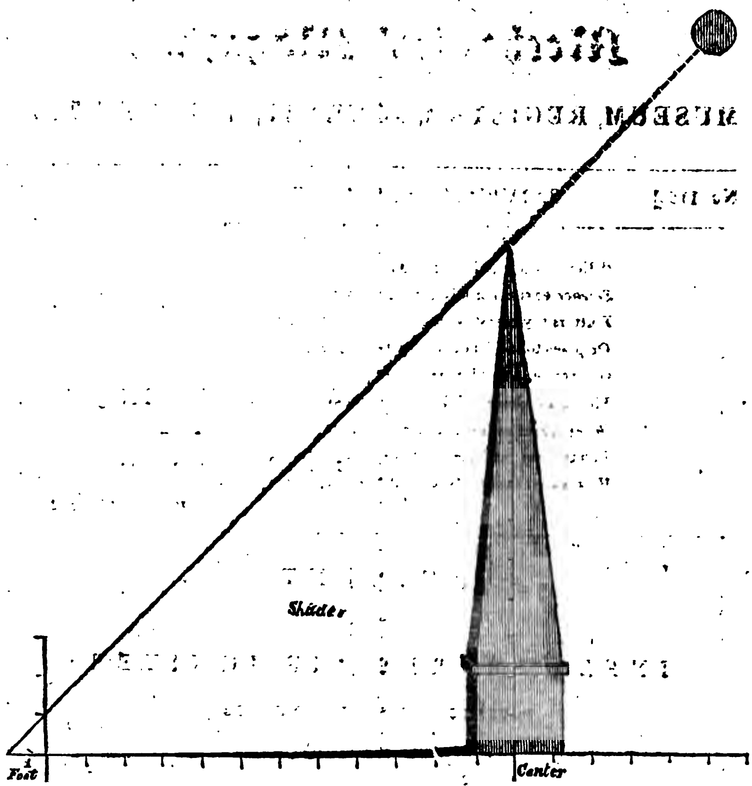
I am, Sir,

Your obedient servant,

Tyro.

Sleaford.

MEASURING ALTITUDES BY SHADOWS.



SIR,—I beg to lay before your readers a description and rough sketch of a method of Measuring Monuments or Obelisks by means of their Shadows.

1st. Place yourself on the opposite side to that which the sun shines upon, and make a mark at the extremity of the shade.

2ndly. Mark off one foot from the first mark, on which point place the end of the measure (a yard measure, for instance), and holding it perpendicularly, take the distance from the ground up to where the sun cuts the measure, which height multiply by the distance from the object and the first mark, which will give the height required.

I am, Sir, yours, &c.

S. W. T.

Warnford-court, Throgmorton-street.

CORRESPONDENCE.

Communications have been received from Philo-Montis—G. M.—Ikey Pringle—C. D.—M. F.—J. B.—P. Isaacs—Dr. Meredith—An Architect—A Student—Hammer—A Reader at Leeds.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills, Jowett*, and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 115.] SATURDAY, NOVEMBER 5, 1825. [Price 3d.

"Nor less to regulate man's moral frame
Science exerts her all-composing sway.
Flutters thy breast with fear, or pants for fame,
Or pines to indolence and spleen a prey,
Or avarice, a fiend more fierce than they?
Flee to the shades of Academus' grove,
Where cares molest not, discord melts away
In harmony, and the pure passions prove
How sweet the words of truth breathed from the lips of love.

Beattie's Minstrel.

ACCOUNT

OF AN

INFLAMMABLE AIR IGNITER.

INVENTED BY SIR J. SENHOUSE.

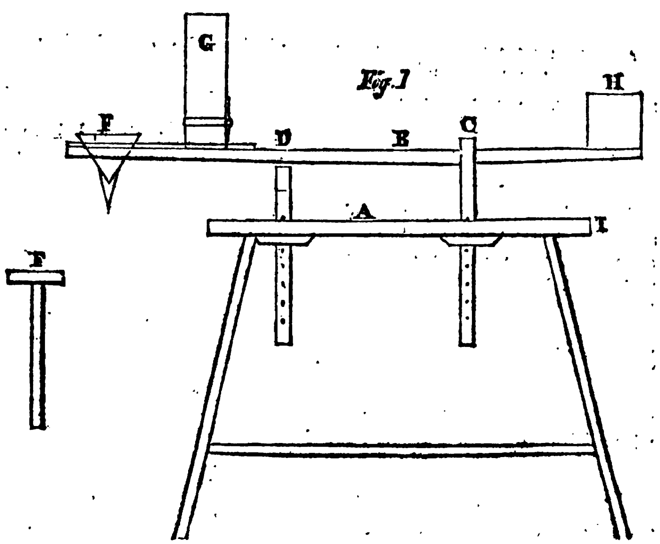


Fig. 2

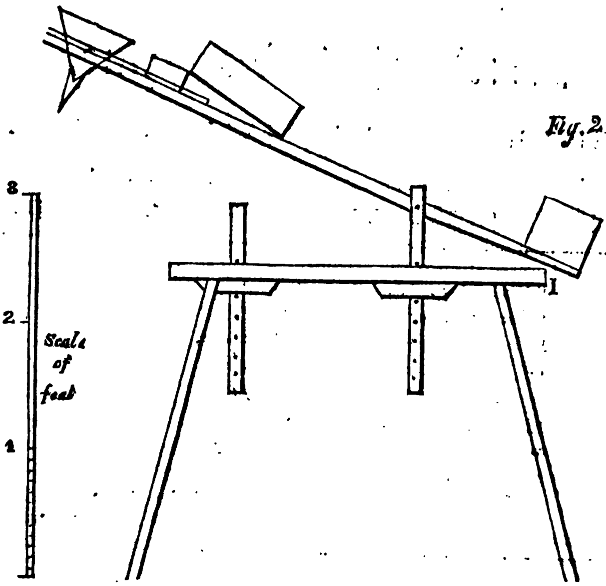
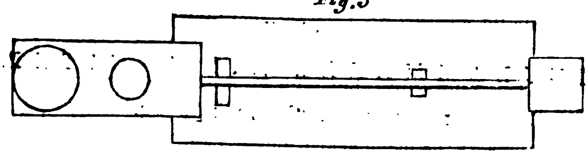


Fig. 3



ACCOUNT OF AN INFLAMMABLE AIR IGNITER.

INVENTED BY SIR JOSEPH SENHOUSE.

[*To the Editor of the Mechanics' Magazine.*]

SIR,—An ingenious friend of mine, acquainted with the nature and effects of inflammable air in coal-mines, suggested to me, some time since, that if an occasional explosion of it could be effected in a pit when the workmen were absent, it would, in his opinion, in a great measure, add to their safety when they returned to their work again; and, as we find, with all imaginable care taken, these dreadful accidents do still occur, and many valuable lives are frequently lost, he thought it would be desirable to make an experiment of this kind. The great danger in causing an explosion, he conceived, would fall upon the person charged with kindling the gas, as he must come in contact with it.

Since that time I have amused myself in constructing a machine, which I call an Igniter. It will act of itself, and leave the lamp bare in half an hour, or a much longer time, if necessary, after it is charged and placed in the inflammable air; this will give the person who placed it there sufficient time to retire into a place of safety. A plan of which I take the liberty of sending you, with a description of it also.

Wishing success to your meritorious undertaking,

I remain, Sir,
Your obedient servant,
J. SENHOUSE.

Hensingham House, near Whitehaven,
August 12th, 1825.

A Description of the Igniter.

FIG. 1.

A, a stool, with four legs stretching outwards, in order to make it stand firmer on the ground.

B, a scale beam.

C, a stanchion, upon which the beam swings : it may be raised or lowered at pleasure, if needful.

D, another stanchion, having a crutch at the top for the beam to rest on when charged, which may also be raised or lowered at pleasure; see fig. 2.

F, a funnel, to be filled with sand or water when an explosion is intended, having a small hole at the bottom, to permit the sand or water to run out gradually.

G, a Davy lamp, with a guard; the latter not to be screwed on, but to lay flat and close to the lamp, having a hinge on one side and a hook on the other, to keep it secure when moved about.

H, a box to contain a weight sufficient to bring down that end of the beam, when the funnel is empty, or perhaps sooner; at this time the guard will fall, and leave the flame so exposed as to ignite the gas.

FIG. 2.

This plan represents the funnel empty, and the beam fallen to I. The guard of the lamp is now so far removed as to leave the flame naked, and enable it to ignite the foul air.

FIG. 3

Is a bird's eye view of the top of the igniter.

VIENNA GREEN.

The process for making this esteemed colour is thus described by Dr. Liebig, in a communication to the French Society for the Encouragement of the Arts and Sciences :

Dissolve with heat, in a copper boiler, one part of verdigris in a sufficient quantity of pure vinegar, and add an aqueous solution of one part of white arsenic. During the mixture of these liquids there commonly forms a dirty green precipitate, which it is necessary, for the beauty of the colour, to make disappear. For this purpose a fresh quantity of vinegar is added, till the precipitate shall be re-dissolved. The mixture is then boiled, and after some time, a granulary crystalline precipitate is formed, of a most beautiful green colour, which, being separated from the liquid, well washed and dried, is nothing else but the green colour in question.

If the liquor still contains an excess of copper, more arsenic is to be added, and if it contains an excess of arsenic, it is necessary to add more copper, operating in other respects in the same manner. It often happens that the liquor contains an excess of acetic acid; in this case it may be employed anew, for dissolving verdigris.

This colour, thus prepared, has a bluish cast; but, in commerce, a deeper and yellower shade is required, retaining the same brightness and beauty. To produce this change it will be sufficient to dissolve a pound of the potash of commerce in a sufficient quantity of water, adding to it ten pounds of the colour obtained by the above process, and heating the whole by a moderate fire. The mass soon deepens in tint, and takes the shade required. If it be boiled too long, the colour will incline to Scheele's green, but will always surpass it in beauty and brilliancy. The alkaline liquor remaining after this treatment may still serve for preparing Scheele's green.*

PERPETUAL MOTION.

SIR,—By T. Bell's own confession, I have *beat* him ! but, as *Mr. Martin* is still in town, I hope not *unmercifully;* although, from his last *tinkle,* "I have got one fear," that, by the encounter, he is a little *more cracked* than before he was so forcibly struck. For, Sir, your well-informed Correspondent now announces to the world a still more *curious* and extraordinary discovery than his "cocks, and springs, and hole in the bottom of his box," and shows how deeply this *divingBell* has explored the arcanum of nature; it being no

* Scheele's green is a combination of deutoxide of arsenic and deutoxide of copper.

less, Sir, than this (let the ladies leave the Court)—that the "*other extreme* of a *young man*" is an "*old woman:*" but by what extraordinary secret process or experiment he has arrived at the knowledge of this curious fact, he has not yet condescended to acquaint you, but, from the kindness evinced in his last communication, "to afford information to any reader in the Mechanics' Magazine who might be unacquainted with the laws of *fluids*," we shall, doubtless, in due time, have it.

It is not true, as assumed by Mr. Bell, that the balls in the tube of the device I gave are, in the engraving, as large as the tube, for the valves are made within that tube, and are smaller than the tube; and, further, if the balls were of the size of the tube, so as to fit tight, they would not fall in the leg containing air any more than they would rise in water. But the object here was not to enlighten your readers, but to give to my device the imperfection of the friction of his own preposterous piston.

I should not, Sir, have intruded myself again upon your notice, had it not been to answer this (accidental) misreprentation, and to add, that, as I shall have a model of the device made for my amusement, I shall be happy to show it to Mr. B. (if he would be disposed to see the balls rise) "with all imperfections on its legs, provided he will put his *in his pocket.*"

I remain, Sir,
Your obedient servant,
PHILO-MONTIS.

SECRETS IN SELLING.

SIR,—I beg you will insert the following answer to the question proposed by a Correspondent, relating to my solution of C. H.'s problem, page 347, vol. IV.

Supposing the temperature to be the same, the elasticity of the air and its density or specific gravity will be convertible terms; now the mercury is supported in the barometer by the elastic force of the air, and hence any change in this force, *i. e.* in the specific gravity of the air, will be accompanied by a corresponding change in the barometer; hence we may easily perceive that the specific gravity, the temperature being given, varies as the altitude of the mercury in the barometer. Now, when the thermometer is at 52°, and barometer at 30°, we find, from Lavoisier's Tables, that the specific gravity of atmospheric air is .00128.

Hence, at any other altitude, it is easy to find the density or specific gravity, the temperature being the same. Thus, to find the specific gravity when the barometer is at 35°, we have, according to the principle laid down, as $30 : 35 :: .00128 \therefore .01493$, which is the specific gravity required; thus the specific gravity of air is found at any height of the barometer at the temperature 52°. I know not how the elasticity varies with the variation of temperature, and should be obliged to any one who could give me the law, which, being once known, it is easy to reduce it to computation. I have lent the Number of your Magazine containing the question about the cork, but will give a general solution adapted to the temperature 52°, which may be easily applied. Let n^3 be the number of cubic inches in the cork, m^3 the number in the weight, s the specific gravity of the cork, o of the weight.

$$\therefore n^3 . s = m^3 . o.$$

This is supposing an equilibrium when the height of barometer is h.

Let the height become $h+x$, and let the increment of specific gravity of air be (a), (n^3-m^3), a = weight lost according to my formula, where a is to be found. By the rule just given,

$$30 : h :: .00128 : \frac{h}{30} . 00128,$$

$$\text{and } 30 : x+h :: .00128 : \frac{x+h}{30} . 00128.$$

$$\text{Hence } \frac{h}{30} . 00128, \ \frac{x+h}{30} . 00128 \text{ are}$$

the specific gravities at the two lines of observation, and their difference

$$\frac{x}{30} . 00128 = a . 0.004266 = a.$$

If there is any error in this hasty communication, in principle or practice, I shall be obliged to any one who would take the trouble to correct it.

I remain, Sir,
Your old Correspondent,
F. O. M.

Nottingham, October 24th, 1825.

QUERY.

Would a pair of bellows (of sufficient size), placed on the poop of a ship, and worked against the sail, impel it? For reasons which I decline giving at present, I am inclined to say no, and that, if the sail were removed, the ship would go back.

ON THE RECTIFICATION OF ALCOHOL WITHOUT HEAT.

BY M. E. TAJOT DECHARME.

[*From the Annales de Chimie.*]

Hitherto alcohol, or more properly brandy, could not be rectified, or raised from an inferior to a higher degree, and consequently be brought to a superior state of purity and strength, except by distillation; an operation which could only be effected by an alembic and some heat.

The mode of rectification here treated of can be performed in the cold, and consequently without the aid of an alembic or of combustibles. The following, in general, is the method of proceeding:—

On the one part there is poured into a vessel, with a flat bottom, a given quantity of the alcohol, which is desired to be rectified, whether it be small spirits (*petites eaux*), proof spirits of Holland, or spirits of a higher degree.

On the other part one of the most deliquescent salts is to be dried, either muriate of lime, or muriate of manganese; the first is preferable in point of economy, and the superiority of the second gives it a claim to be chosen, but it is less common, and not so easily obtained.

In another vessel of a large surface, and placed on three or more feet in the vessel which contains the spirits, is to be put the muriate of lime dried and pounded.

This disposition being made, the vessel which holds the alcohol is to be closed up completely, or its edges are to be secured with bands of paper pasted over them, and the whole is to be left in this state for four or five days. After this time the vessel holding the spirits is opened, and that containing the muriate is taken out. This salt is then found to be more or less dissolved, according to the quantity of water which it has attracted. The degree of strength of the spirits is then examined, and it is found to be increased 5, 6, or 8 degrees, according to the fineness of the grain of the dry muriate; it ought not, however, to be too fine, to prevent its becoming pasty, and to make its surface more extensive; the vessel holding the muriate is then cleaned, a new portion of the dry muriate is spread on it, and it is put back into its place, and then the vessel containing the spirits is again shut up in the same manner as before the insertion of this second dose of deliquescent salt.

By operating successively in this manner, highly rectified alcohol is obtained, and weak spirits of 10 or 15 degrees (of Beaumé's areometer) are raised to 40 or 42 degrees.

It may be conceived that this method may be applied to the concentration of various saline fluids, acids, &c. and that by a particular disposition of the factory, basins, &c. it would be easy to establish a rotation (of the processes), which, in a given time, would afford at pleasure daily products of all degrees of concentration.

M. Decharme is at present employed in trying to give to this process, by the aid of mechanism and natural philosophy, all the regularity, precision, and perfection, desirable for a work on a large scale.

MONUMENT AT WATERLOO.

Extract of a Letter from Mr. J. Deville, 367, Strand:—

"While engaged going over the plains of Waterloo, my attention was often attracted by a most stupendous work going on, men, horses, and carts, in great numbers, being employed; but from the interest I felt in the details of the battle, and in the guide's description, it was some length of time before I could inquire what the building was intended for; at length the opportunity served, and, upon inquiry, I found it to be a monument which the Government of the Netherlands had ordered to be erected on the spot where the immortal hero, the Duke of Wellington, and those who partook with him in the glory of that day, stood, and where he issued those commands which decided that great event. The Duke's head-quarters, at the commencement of the engagement, were between two hills, on the road from

Brussels to Charleroi, behind the farm of La Haye Sainte; but the French getting possession of that farm, the Duke then moved his head-quarters about two or three hundred yards to the right, on the rising ground on which this monument is now erecting. This Monument, as it is called, has a very imposing effect even in its unfinished state. It is an earthen mound or hill, of a conical form, resembling the one on the Bath road, near Kennett; but of larger dimensions, and more striking appearance. It is of immense size, being upwards of seven hundred feet diameter at the base, or two thousand one hundred and sixty feet circumference. It is two hundred feet high, and one hundred feet in diameter at the top; there is a double carriage-road winding round it, in a spiral form, and supplying an easy means of ascent, for carriages, to the very top; and by this road the materials have been, and are conveyed, to complete the work. In the centre is a shaft of brick-work, which has been carried up from the bottom, and is still going on. It is to be sixty feet higher than the top of the eastern mound, making the whole height two hundred and sixty feet. It is intended for a pedestal, to receive a lion (which, I understand, is the crest or arms of Belgium), twenty-one feet long, and twelve feet high, which is ready to be put up when the work is finished. The mound has been eighteen months in hand, and is to be completed within six more, and, from what has been already done, little doubt remains that it will be so. For the first twelve months 2000 men, 600 horses, and as many carts as could be kept at work, were employed on it, and the number has only been reduced as the termination of this great undertaking approaches. As I before mentioned, it is of a conical form, with the top cut off, and out of it the shaft or pedestal for the lion rises. At present, as the works are going on, at top it has a pleasing appearance, from the great number of horses, carts, and people ascending and descending by the winding road."

ON BREWING.

SIR,—Being a constant reader of your valuable Magazine, I observed, as far back as May 14th, and at subsequent periods, inquiries have been made concerning Brewing, the comparative strength of malt and sugar, &c. I expected to have had some valuable information on the subject long before this time, but little elucidation has yet been given: will you allow me to state a few practical remarks that I have made?

The first grand step towards bringing to perfection brewing, wine-making, fermenting, and distilling (as they are children of the same family), is to have a universal hydrometer, or floating ball, to take the strength and value of worts, extracts, and spirits. It should be divested of all arbitrary and local phrases, described in one plain, simple, and universal language; we could then communicate the results of our practice to each other, and be understood. I know of none so simple and effective as specific gravity—it is the groundwork or father of all others, and a language known in all parts of the kingdom.

Impressed with this idea, about fifteen years ago, I made my first attempt at scientific brewing, by superintending that process for my own family. Our brewing is small, consisting of about six bushels, six or seven times in the year, without regard to season or weather. I use a thermometer to try the heats of water in mashing, and worts in fermenting. I have also got made in the country a very simple hydrometer, consisting of a floating ball and a few weights, with which I take the specific gravity of my worts and extract, and the strength of spirits, as I sometimes experiment on distilling in a small way, and occasionally manufacture a little family wine. I have formed tables of specific gravity, corresponding with pounds and ounces of density and dry extract, as used by Dring and Fage, Dicas, and others; with the quantity of spirits created by different degrees of attenuation; I have kept a journal of proceedings, and the results: and if a description of the instrument, or the construction of the tables, or any other part of the process I have used, would in any way tend to simplify or render more easy the practice of brewing, which at present is very imperfectly and irregularly performed, I would most willingly send

any thing I am in possession of to you for insertion.

As your Leominster Correspondent has expressed a wish for a practical report, I have here sent a rough outline, with the probable results, which will vary with the circumstances. As addition is the easiest rule in arithmetic, I have stated the process in the proportion of one single bushel of malt, and the produce calculated to one gallon, in lieu of a barrel, as it is usually given.

To Mash.

Put ten gallons of boiling water into a tub, furnished with the usual appendages for drawing off the wort; when the water is cooled down to 180°, put to it one bushel of good malt; the coarser it is ground the better, so that every corn is broken (cylinders that bruise the grain are better than mills that grind it into flour); stir up the water and malt well together, let it stand three hours, then draw it off, and you will have six gallons, four having been absorbed by the malt.

Second Mash.

Put on five gallons of water, at 183°, stir it up well, and let it stand on two hours; let it then run, and you will have five gallons off.

Third Mash.

With about three gallons of water, at 186°; stir it up as before; let it stand on about an hour, and you will draw off about the same quantity as you put water on.

Fourth Mash, for Small.

Six gallons of water, at 190°; let it stand on during the time the ale is boiling.

Boil the Ale.

Put the three first mashings, which are about fourteen gallons, on the furnace, with one pound of good hops; let it boil as fast as possible one hour, then strain it off, and you will have little more than ten gallons.

Boil the Small.

Put the fourth mashing, of six gallons, into the furnace, and return the hops strained from the ale; let it boil as fast as possible one hour and a half, or until it is reduced to about four gallons.

Produce.

The first strain-off of the ale will be ten gallons; at the heat of 75°, will be of the specific gravity of 1.077. The increase of weight or density, as it is called, will be about 7lb. 14 oz. heavier than the water weighed before it was put over the malt, and will contain 20lb. of dry extract, equal to 2lb. per gallon.—The small beer will have the specific gravity of 1.020—about 8 oz. of dry extract per gallon, or 2lb. the whole. Thus you have extracted and obtained 22lb. of soluble matter from one bushel of malt. From 19lb. to 23lb. per bushel is the usual quantity, and I much doubt if more than 16lb. or 18lb. is, on the average, got from a bushel of malt, where the process is conducted by the rule of thumb.

Fermentation.

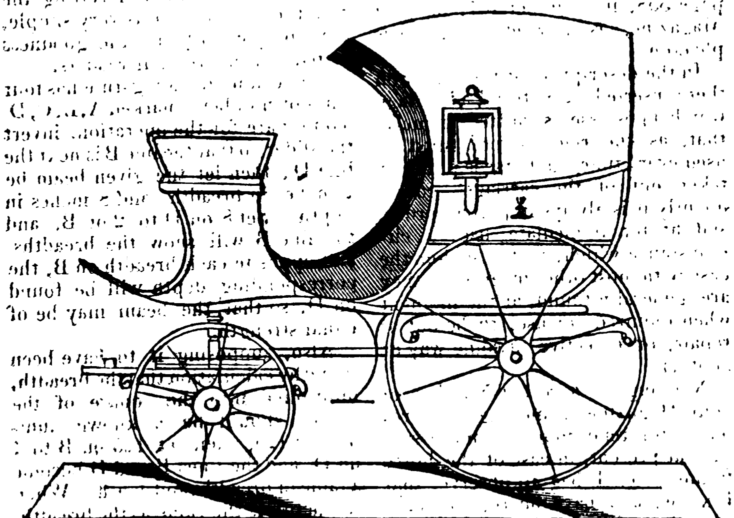
The grand and most important process remains yet to be performed. I wish I could do justice to the description of it. As soon as you have strained off the ale, put it into shallow vessels, and get the first violent heat out of it as soon as possible. Put three or four quarts into a very shallow vessel, and cool it down to 80°; put to it about a quarter of a pint of good fresh yeast; then empty it into a deep narrow vessel, and it will ferment rapidly. In the mean time the other is cooling, and when reduced down to 75°, put them altogether in the working tub, which should be deep, and not too wide. In about nine or ten hours it will be in a high state of fermentation, with a fine white curly head of yeast, like a cauliflower; let it continue in that state until the bulbs that are formed in the yeast begin to look thick, heavy, and dim, and true or solid yeast is beginning to be formed; that is the time to tun it, or put it into the cask, before the head has fallen, when it is in the highest and most vigorous state of fermentation. The length of time it will require to

arrive at that state is very difficult to describe, varying, according to circumstances, from 18 to 36 hours. When tunned, as it is called with us, that is, put into the cask, it must be quite full, and the bung put in the top, and it will throw out yeast, or cleanse itself, from the top corkhole in the front of the cask, just below the head, and it must be filled up every two or three hours, until it ceases to throw out any more yeast. Then cork up the cask, pull out the bung at top, fill it up tip full, and it will throw up more yeast, which must be skimmed off occasionally as long as any is formed; then take a little beer out, just to sink it down so that it does not touch the head of the cask; put the bung loosely in, and in a few days, or when it has ceased to ferment, and is reduced to the same temperature as the cellar, bung it down tight. In a month or less after you may tap it, and have a good and wholesome beverage, rich in flavour, pleasant, good tasted, and as fine as wine.

I remain, Sir,
Your old servant,
EXPERIMENTUM CRUCIS.

Stratford on Avon.

WINTER PHAETON.



SIR,—Your obliging insertion of my former communications, has induced me to offer the present for a similar favour.

From the general use of low Phaetons, and their great utility and convenience, I send you the accompanying sketch of one on a new principle, adapted for the winter season, as it combines the advantages of the French *chaise de poste* and German *caleche*, so much used by travellers on the Continent, for effectual protection against the inclemency of the weather, with the lightness of appearance and ease of draught of a one-horse phaeton.

The front light, or window, is of a very simple and perfect construction, as there are no loose leather flaps, or curtains, required, which are generally used in other carriages of the kind, and found so very inconvenient and troublesome in wet weather.

The head part can be made to move up and down, as common, or remain a fixture, with glasses in the sides. The body is to contain two or three persons—the front dickey seat for the driver. It is remarkably easy, as the

body swings on the carriage with leather braces attached to the springs, and, from its light and simple construction, may be drawn with perfect ease by one horse, though made with conveniences for attaching two, when it may be required.

The new-constructed phaeton is particularly adapted for professional gentlemen and others, who are much in the weather, as it possesses every convenience of a chariot, or other close carriage, at (from the advantages possessed by the inventor for its construction) one-third less of the expense.

The important invention of releasing the horse from the carriage, in case of accident, as described at page 358, in Number 107, of your Magazine, is applied to the new phaeton.

In the description of the invention there inserted, a material advantage which it possesses is omitted, namely, that, as the release-work must be used every time the horse is put in or taken out of the carriage, consequently it is always in perfect order, and fit for immediate use—a circumstance which, as it is seldom the case with most other inventions, they are generally found, at the moment when required for use, to be out of repair, or defective in some way or another.

Noticing, in a recent Number of your Magazine, some ingenious remarks for rendering gigs more safe than at present, in case of the horse falling, &c. I beg to observe, that I know, and have heard, of many inventions for that purpose, all of which have failed in effectually accomplishing so desirable an object. The fact is, lightness of appearance and fashion are so much required in gigs, that it is difficult to obtain safety (to meet with general adoption) in any other way than by constructing them as low as possible.

The insecurity thus existing in gigs, renders low phaetons so desirable for general use, particularly for families and timid individuals, as, with the invention for instantaneously releasing the horse in case of accident, they may always be rode in perfect safety.

Every information respecting the new-constructed phaetons, and likewise of the release-apparatus, will be furnished by sending an address to 25, Bow-street, Long Acre, or by applying at Mr. Comyns's Coach-Manufactory, Piccadilly. G. M.

APPLICATION OF THE SLIDING-RULE TO FACILITATE CALCULATIONS OF THE STRENGTH OF MATERIALS.

[*From the Repertory of Inventions.*]

It does not appear to be very generally known, that the common Sliding-Rule can be applied to form a table of the breadths and depths of a series of beams of equal strength; and, as the operation of setting the rule for this purpose is very simple, perhaps you will have the goodness to place it before your readers.

The common sliding-rule has four lines of numbers, marked A, B, C, D. To prepare for the operation, invert the slider so that the line B is next the line D; then let the given beam be 2 inches in breadth, and 8 inches in depth. Set 8 on D to 2 on B, and the line B will show the breadths, and opposite each breadth on B, the corresponding depth will be found on D, so that the beam may be of equal strength.

Also, supposing it to have been found by calculation that the breadth, multiplied into the square of the depth, should be a known number, as 125, then set 125 on B to 1 on D, and the lines B and D become a table of breadths and depths. When the depth is the same as the breadth, the number is the cube root of 125, or of the number set to unity on D: in this case it is 5.

By means of Mr. Bevan's sliding-rule, a table of breadths and depths for beams or bars, of equal stiffness, may be exhibited. Thus, insert the slider E, inverted, between the lines A and D, and E becomes a line of breadths, and D a line of depths for beams of equal stiffness. If it be desired to know the breadth of a beam 10 inches deep, so that it shall be equally as stiff as a beam 8 inches square, set 8 on E to 8 on D, and opposite 10 on D we have 4·1 on E, which is the breadth required.

When the number on E is equal to the opposite one on D, the number is the fourth root of the number on E, which is opposite to 1 on D. Hence we have a means of knowing the fourth root of any number at once by inspection.

The sliding-rule is already a most useful pocket-companion for those who have intricate calculations to make, when there is neither time nor opportunity to refer to tables; and if these few hints add any thing to its utility, it will afford considerable pleasure to your most obedient,

T——.

PREVENTION OF STEAM-BOAT ACCIDENTS.

The disastrous accident which lately befel the Steam-boat Comet, by which upwards of fifty persons lost their lives, has produced the following letter from Captain Basil Hall, on the means of guarding against such fatal occurrences in future. It deserves an attentive consideration, as coming from a Gentleman whose science and nautical skill confer a high value on his authority.

"In reply to your questions respecting the best method of guarding against such fatal accidents as that which lately befel the *Comet* steam-boat, I beg leave to state one or two precautions, which I think would give great additional security to steam navigation.

"In the first place, every steam-vessel ought to carry a light in her bow, and this ought not to be a mere lanthorn, made fast to the gunwale or tied to the rigging, but should be fixed in midships, on the top of a pillar, raised seven or eight feet above the deck, so that the light might not be interrupted by any one standing before it. The light itself ought to consist of two lamps, with reflectors in separate compartments, in case of one blowing out while trimming. This lanthorn or light-house should be made of strong glass, and rendered water-tight, so that the spray or rain might not extinguish the lights in bad weather. It would be of consequence that these lights in all steam-vessels were made of the same size and height, and carefully screened towards the stern, to prevent mistakes.

"A regulation ought, in the next place, to be universally established, similar to that used in the Clyde, by which two steam-vessels, when meeting, should observe the same law as coaches, and invariably take the left hand.

"One look-out man ought to be stationed in the bow, who should always be a seaman, capable not only of calling out to the steersman of his own vessel which way to put the helm, but competent also to hail other vessels, to give the requisite information for their guidance.

"It is absolutely essential, in the next place, I conceive, to the safety of steam-vessels, that no jibs or other head-sails should be carried after sun-set. These sails not only intercept the light, but prevent the look-out man from distinguishing objects a-head, and in all cases of rencontre are very perplexing to both parties. If this important regulation were established, one look-out man would be much better than two, as all embarrassment arising from contradictory orders would be avoided. In sailing vessels it is different; they cannot do without headsails, and one look-out man on each side is consequently indispensable.

"It is much to be wished, that every steam-vessel were fitted with the admirable contrivance, invented by Messrs. Carmichael, engineers, of Dundee,* by which the machinery of the engine is so regulated, that, by the mere turning of a handle on deck, the vessel may be made to go a-head or a-stern, or may be suddenly stopped, at pleasure. This contrivance is so simple and obvious, that it may be used, under directions from the captain, by the most ignorant passenger, as effectually as by the most skilful engineer. A dial-plate, with a handle, like that of a clock, points out what is to be done, and a turn of a lever, backwards or forwards, performs the whole work, without the necessity of calling out to the engineer below, and thus the machinery

* Described in Mech. Mag. No. 101.

is as completely under the control of the master as the rudder.

"In some steam-vessels the tiller ropes are absurdly led crosswise, in such a way, that when the wheel is turned, as on board ship, a different effect is produced on the rudder. This is done to save the ropes from chaffing, or some such petty object, but it is in the highest degree mischievous—as in a case of danger or difficulty, any seaman, recently shipped on board, who should seize hold of the wheel, would inevitably turn it the wrong way, and instead of steering the vessel clear of an obstacle, go directly against it.

"I remain, &c.

"BASIL HALL."

NEW IMPROVED SAFETY-BOATS AND LIFE-BOATS.

It has frequently been our pleasing duty to notice meritorious inventions, having, for their object, the safety of our fellow-creatures who traverse the ocean, and the salvation of lives in cases of shipwreck. In laying before our readers a brief account of the improved Boats, on a system contrived by Mr. Andrew Hennessy, of Cork, we feel a more than usual gratification, from a conviction that he has succeeded in removing many of the hitherto-existing obstacles to the formation of a life-boat, which shall be so indestructible as to be available in cases even of the most imminent peril. Mr. Hennessy, of Cork, was regularly bred as a naval architect; he went to sea at an early age, and was one of a few, who, in the shipwreck of a large vessel, was saved from a fearful death. The impression of the awful calamity excited an idea in his youthful mind of constructing a boat, which, not being liable to be stove in, or crushed on rock or wreck, might, in cases of danger, be the means of saving the lives of the crews. He long cherished the expectation of success, and, with such materials as he could procure, tried a number of experiments during the course of his hours of relaxation from his regular employment; but twenty years elapsed before his circumstances enabled him to bring his plans to maturity. The loss of his Majesty's ship Confiance on the coast on which he resided, and the dreadful calamity attending it, at length determined him to devote his whole attention to his favourite and truly benevolent project—for he looked for no remuneration beyond the value of his time, and cheerfully divulged his plans for the benefit of those to whom they might be useful. He constructed a number of models, and proceeded to London in 1822, in the hope of there meeting with that patronage and support which were necessary to complete his designs, on a scale which should ensure their full success and practical adoption. His models were much admired, but he received no adequate encouragement until they were minutely examined and approved of by the Committee of the Trinity Board, who advised him to persevere, and provided him with the means of procuring proper materials—without which assistance, he gratefully acknowledges he could never have brought his plans to their present improvement. On his return home, he applied himself with new vigour to his task, and after a variety of experiments, conducted at much expense, he completed several small boats, and one of a large size, all of which appear to be impervious alike to the buffetings of the waves, and to the contact with rocks, or other bodies, which generally destroy the ordinary life-boat. This grand desideratum is attained by essential novelties in their construction—their ribs or timbers being elastic, and their bottoms and sides covered (we shall not say planked) with a peculiarly strong *cloth*, impenetrable by water. Our readers will require no further proof of the excellence of this kind of vessel than the fact, that the ingenious builder, in company with five seamen, actually sailed in one of them from Cork, on the 7th ult., for England, and was in the Channel during one of the late tremendous gales, when his little vessel rode it out in a mountainous sea, with a degree of ease and safety which exceeded his most

sanguine expectations. After anchoring at Fishguard, he proceeded to this port, where he arrived on the 15th ult., all well. The boat, which is of the whale-boat model, that being found by experience to be the safest, is about 40 feet in length and 8 in breadth; she may be of about 20 tons burden; but it may puzzle the Custom-house officers to determine her true admeasurement, for such is her capacity of expansion and contraction, that she may be squeezed up seven or eight feet in length by a sudden shock, and be similarly reduced in breadth. This elasticity constitutes her grand excellence, for a shock which would crush any common boat to pieces, leaves no more impression upon her than a blow does upon a football. Her keel, stem, and stern post, are formed of one piece of timber, steam-bent, and so contrived, that if she were driven, end on, against a pier, it would spring back and deaden the blow. Her ribs or timbers, each of which runs from gunwale to gunwale in a piece, are of white oak, like bows; both on the outer and inner surface of each is a thin lath of whalebone, and they are served or corded in the manner sometimes adopted with coach springs. The beams supporting the deck are attached to a gunwale piece inside, by mortices and iron joints, which admit of expansion or contraction; the deck is merely loose boards; and over the whole, the cloth alluded to, made to fit the model, is tightly laced to the gunwale, and supplies the place both of plank and ceiling. This cloth, which is of Mr. Hennessy's own invention, is a twilled fabric, nearly a quarter of an inch in thickness, a mixture of hemp and wool, prepared by a peculiar process so as to be perfectly water-tight, and not liable to rot or mildew. The inventor has on board several varieties of this cloth, one of which is most ingeniously inwrought with copper, after the manner of the scales of a fish, intended as a specimen for trial on the bottom of a similar elastic boat. The vessel is of the ketch rig; but the cloth, which is stretched, as it were, in ridges on the ribs, offers considerable resistance to the water, and somewhat impedes her sailing. This, however, may easily be remedied by placing thin deals, or laths, longitudinally between the ribs and the canvas. On the forecastle, Mr. H. brought one of his small open boats, made on the same principle, which can be taken to pieces, and the whole folded like a book. The boats may be made of any size; they are susceptible of all the *floating* contrivances applied to other life-boats, with the grand advantage of being impregnable to blows, which so often render other boats useless at the very moment of danger.

It is Mr. Hennessy's intention to proceed by canal, in his little vessel, to London, and afterwards to sail over to Paris; his object being, by exhibiting his boats, and explaining their peculiar construction (of which our account gives but a feeble idea), to derive from a generous public the means of defraying the heavy expenses he has incurred in their completion, and of meeting the engagements to which, with a large family depending on his exertions, his enthusiastic labours in this good cause have subjected him.—*Leeds Mercury*.

EMERSON'S MECHANICS:

NEW EDITION, BY SMEATON.

We congratulate the cultivators of mechanical science on the appearance of this new edition of Emerson's Book of Elements, which, they require not to be informed, is by far the most profound and exact which has yet appeared on the subject. The present edition is not only the latest, but the best. It is printed with great correctness and elegance; and the engravings, which are on copper, are drawn with an attention to perspective, which was wanting in the original. The text is also, for the first time, enriched by a number of well-conceived and very prettily executed emblematical wood-cuts. But the most valuable novelty about this new edition, is an Appendix, by

Mr. Smeaton, of "Explanatory Notes, Illustrations, and Observations." A good deal that is obscure, because too learnedly expressed in the text, is here explained in a very plain and satisfactory manner; and whatever new matter has arisen in the progress of science since Emerson's time, is carefully and intelligently supplied. The following selections from this portion of the volume will serve as specimens of the knowledge and ability with which it has been edited.

Emerson states in the text, "that a fish is nearly of the same specific gravity as water; and most fish have a bladder which they can *expand* or *contract*, and so make themselves *lighter* or *heavier* than water, in order to rise or fall in it." Mr. Smeaton adds, on this subject, the following very ingenious observations:—

"EXAMPLE 42, *Page* 187.—It has often struck me, in observing the motion of a fish in water, that the air-bladder has other purposes than that of simply rendering it lighter or heavier than the surrounding water, so as to enable it to raise and sink itself at pleasure, for frequently the fish is in a perpendicular direction, either with its head or tail elevated: now, it is worth inquiry, whether the fish has it not in its power to alter its centre of gravity by means of the air-bladder, so that its head or tail should preponderate, thus enabling it to steer itself in any oblique or perpendicular direction in the fluid? For, by very attentive observation on some gold fish in a large reservoir, it appeared to me, that the action of the fins and tail was insufficient for the purpose, and that they seemed only to use the fins as a means of balancing themselves, or steadying their position; for if the air-bladder is capable of but a small movement, either towards the head or tail, it must necessarily cause one end to preponderate, and thus, as it shifts the centre of gravity of the body of the fish, it must produce a corresponding ascent or descent obliquely of the head of it; and thus, by a very simple piece of mechanism, give the fish the means of advancing in any required direction. I am not aware that this idea has occurred to naturalists, but as all nature is subject to mechanical laws, it is worth their consideration, it being foreign to our purpose to enter on the anatomy of the fish, though I think I could show that such a property existed, from that consideration."

"PROP. 58.—*Centre of Oscillation.*—In order that no misconception may arise from the definition of this point, which is, that if all the particles of the body were concentrated in a certain part of a vibrating or oscillating body, it would vibrate or oscillate in the same time as the whole body, let us suppose that a pendulum is devoid of weight, except at the point, which, if it had weight, would be its centre of gravity. In this case the centre of gravity would be the centre of oscillation; but as every body has weight, even the smallest wire which might compose the pendulum, that point, viz. the centre of oscillation, must be different to the point where the centre of gravity of the wire or bar composing the pendulum is situated. Thus, if we suppose a bar of a certain length, of equal size throughout, and a weight suspended by a very fine thread, which, for the sake of illustration, we will suppose of no sensible weight, to which is attached, at its end, a weight, equal in weight to the bar, and if both pendulums were of the same length, they would vibrate, not in equal times, as the absolute weight of the one was dispersed throughout its whole length, and the other was concentrated at one point; so there must be a point in the former, in which, if we suppose its whole weight transferred, will make it vibrate in the same time as the latter, and this point is called the centre of oscillation; for when the bob of a pendulum is very heavy, in respect of the pendulum rod itself, the centre of oscillation corresponds nearly to the centre of the bob or ball at the end of the pendulum rod; and thus we say, a pendulum is of a certain length to vibrate in a certain time. We take for the length of the pendulum the distance of the centre of oscillation from the centre of sus-

pension, and then, if the pendulum is composed of a bar, or even an irregular figure, if we can find its centre of oscillation, and measure from that point to the centre of suspension, we can calculate the number of vibrations it will make in a given time."

INCREASING THE SOUND OF CANNON —ADVANTAGES AT SEA.

Sir,—I think the public will agree with your Correspondent, Mr. Welsh, that cannon tell our joys to heaven as loudly as we can desire. To a philosopher it must appear somewhat childish to endeavour to charm the clouds of grief from our minds as savages do the shadow of the earth from the moon by noise and clamour. But I do not agree with him, that "his discovery is of little moment;" it might be rendered essentially serviceable for increasing the sound of guns fired by a ship in distress.

I am, Sir,

Your most obedient servant,

Phinta.

London, October 24th, 1825.

PROPAGATING FRUIT TREES BY GRAFTING.

The best luting wherewith to cover the newly grafted scions is composed of equal quantities of train oil and rosin, prepared in the following manner:—First, melt the rosin in an earthen vessel, then pour in the oil; mix them well; to be applied, when cold, with a painter's brush. This composition is used in the north-west part of France (Bretagne) with general success. It has this advantage, that it never cracks, nor admits rain or wind to the grafts, which is the usual cause of their failing. It is more expeditiously put on than the common clay covering, and looks much neater; but what renders it more useful is, that the grafts covered with this composition seldom fail. Scions laid under earth, or steeped in water for a few days, grow better than those taken from the parent tree. Grafting cherry or pear trees should not be delayed later than the 17th of March.

GLAZING EARTHENWARE.

M. Röchinski, a manufacturer of earthenware at Berlin, has found a varnish or glazing for common pottery, which, after trials made in the presence of the College of Medicine, offers no danger in regard to health, and resists the action of acids. This glazing is composed of five parts of litharge, two parts of well purified clay, and one part of sulphur. These substances are pulverised, and mixed with a sufficient quantity of caustic alkaline lie (soap-makers' liquor), so as to form a mixture fit to be readily applied on the earthenware, and to cover it equally all over. Carefully baked, these wares offer no trace of lead.

IRON STEAM-BOAT.

A boat of sheet iron, intended for a passage-boat, from Colombia, on the Susquehanna, to Northumberland, is constructing at York, in this State. The following is an account of the boat, and of the steam-engine by which it is to be propelled:—

The boat has 60 feet keel, 9 feet beam, and is 3 feet high; she is composed entirely of sheet iron, riveted with iron rivets; and the ribs, which are one foot apart, are strips of sheet iron, which, by their peculiar form, are supposed to possess thrice the strength of the same weight of iron in the square or flat form.

The whole weight of iron in the boat, when she shall be finished, will be 3400lb.; that of the wood work, decks, cabin, &c. will be 2600lb.; being together three tons. The steam-engine, the boiler included, will weigh two tons; making the whole weight of the boat and engine but five tons.

She will draw, when launched, but five inches, and every additional ton which may be put on board of her will sink her one inch in the water.

The engine is upon the high pressure principle, calculated to bear 600lb. to the inch, and the engine will be worked with not more than 100lb. to the inch. It will have an eight-horse power, and the boiler is formed so that the anthricite coal will be used to produce steam. The ingenuity with which the boiler is constructed, and its entire competency for burning the Susquehanna coal, are entitled to particular notice; and the inventors, if they succeed in this experiment, will be entitled to the thanks of every Pennsylvanian.

The boiler is so constructed as that every part of the receptacle for the fire is surrounded by the water intended to be converted into steam; and thus the iron is preserved from injury by the excessive heat produced by the combustion of the coal. Its form is cylindrical; its length about six feet, and it will be placed upright in the boat, occupying, with the whole engine, not more than ten feet by six feet.

The engine is nearly completed. The whole cost of the boat and engine will be 3000 dollars.

INQUIRIES.

NO. 165.

STEAM MACHINERY WANTED.

Sir,—I shall be obliged to your readers to suggest a mode for applying the Steam from a Boiler (of about 60 gallons) to the turning of a Chaff-cutter and Hand Corn-mill. The steam, at present, is only used for steaming hay and potatoes for cattle; and the apparatus consists of nothing more than the boiler and a pipe, by which the steam is conveyed to the boxes containing the above articles.

I doubt not your ingenious Correspondents will kindly communicate by what machinery the steam may be rendered more generally useful, particularly in the accomplishment of the above objects.

I am, Sir,
Your obedient servant,
H. K.

NO. 166.

PLASTER OR MORTAR FLOORS.

Sir,—I shall be obliged to any of your Correspondents who will favour me with the best method of making plaster or mortar floors, for cottages, sleeping-rooms, &c.; detailing the whole process of making the composition and applying it. I have seen floors to sleeping-rooms in houses in Derbyshire and elsewhere, of the first consequence; they had all the appearance of a whitish stone, somewhat gritty, and possessed many advantages over boards, especially for cottage floors, being clean, durable, and safe from fire. I beg information on this subject.

I remain, Sir,
Your obedient servant,
A Mason.

NO. 167.

MANAGEMENT OF BEES.

Sir,—Having commenced apiarist, and consulted Huish's work on the Management of Bees, I feel desirous of constructing a deprivation-hive on his principle; but, as he has only given the size of the pieces of wood fixed at the top, without either stating the size of the hive or the distance it is requisite to place the pieces of wood asunder, I am wholly at a loss how to proceed, and should be greatly obliged to any of your Correspondents who will be at the trouble of giving the information required through the medium of your very excellent Magazine.

I remain, Sir,
Your obliged servant,
J. B——ge.

Derby.

ANSWER TO INQUIRY.

No. 160.

RAISING WATER TO PRIMROSE-HILL.

SIR,—In answer to Inquiry, No. 160, vol. IV., it would take a steam-engine, on Boulton and Watt's principle, of 77 horse power to raise 1100 tons of water a foot high per minute.

I am, Sir,

Your obedient servant,

A CRIPPLE.

October 18th, 1825.

NEW PATENTS.

W. Duesbury, Boasal, Derbyshire, colour-manufacturer; for a mode of preparing or manufacturing a white from the impure native sulphate of barytes.—Sept. 29.

J. Martineau, the younger, City-road, engineer, and H. W. Smith, Lawrence Pountney-place; for improvements in the manufacture of steel.—Oct. 6.

Sir G. Cayley, Brompton, Yorkshire, Bart.; for a new locomotive apparatus.—Oct. 6.

J. S. Broadwood, Great Pultney-street, piano-forte maker; for improvements in square piano-fortes.—Oct. 6.

T. Howard, New Broad-street, merchant; for a vapour engine.—Oct. 13.

N. Kimball, New York, merchant; for a process of converting iron into steel.—Oct. 13.

B. Saunders, Bromsgrove, Worcestershire, button manufacturer; for improvements in constructing or making of buttons.—Oct. 13.

T. Dwyer, Lower Ridge-street, Dublin, silk manufacturer; for improvements in the manufacture of buttons.—Oct. 13.

J. C. Daniell, Stoke, Wilts, clothier; for improvements in machinery applicable to the weaving of woollen cloth.—Oct. 13.

J. Easton, Bradford, Somersetshire; for improvements in locomotive or steam-carriages, and also in the manner of constructing the roads or ways for the same to travel over.—Oct. 13.

W. Hirst, J. Wood, and J. Rogerson, Leeds; for improvements in machinery for raising and dressing of cloth.—Oct. 21.

R. S. Pemberton, and J. Morgan, Lanelly, Carmarthenshire; for a consolidated or combined drawing and forcing pump.—Oct. 21.

G. Gurney, Argyle-street, Middlesex, surgeon; for improvements in the apparatus for raising or generating steam.—Oct. 21.

L. W. Wright, Princes-street, Lambeth, Surrey, engineer; for improvements in the construction of steam-engines.—Oct. 21.

H. C. Jennings, Devonshire-street, Middlesex, practical chemist; for improvements in the process of refining sugar.—Oct. 22.

NOTICES TO CORRESPONDENTS.

The communications of S—, RR, and one or two others, intended for insertion in this Number, are unavoidably deferred till our next.

We shall obtain the information desired by "A Builder" before next week.

Communications have been received from T. M. B.—A Measure-Maker—R. O.—J. Ball—An Ornithologist—A Constant Reader—N. H.—S. Whitby—G. M.—G. B.—Drangam—Polyphilus—A Liverpool Brewer—A. D. H.—Vidi—Careful—R. H.—An experienced Gardener.

*** *Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills*, *Jowett*, and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

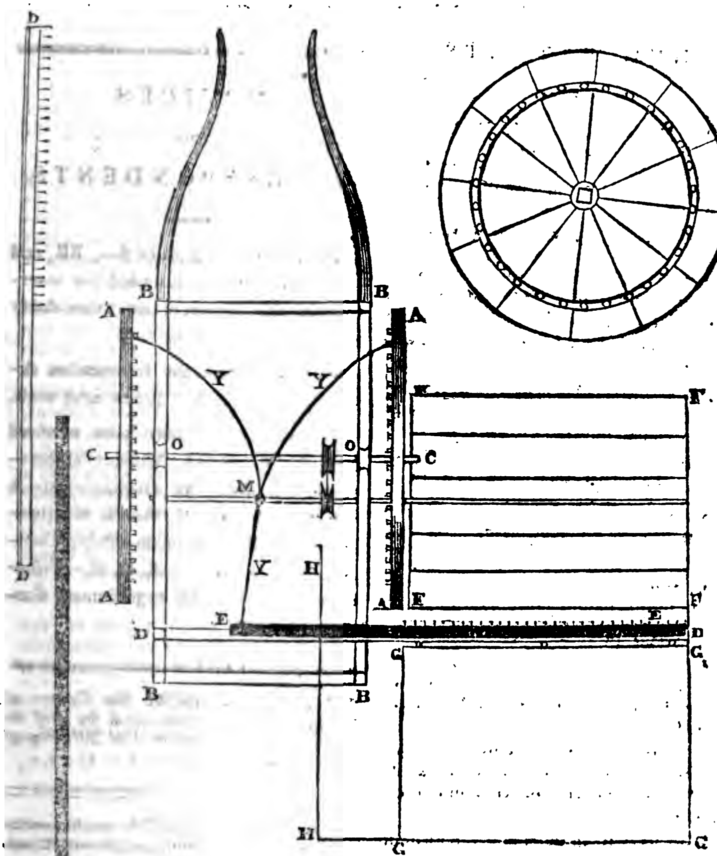
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 116.] SATURDAY, NOVEMBER 12, 1825. [Price 3*d*.

"All science arises from observations on practice. Practice has always gone before method and rule; but method and rule have afterwards improved and perfected practice in every art."—*Blair.*

OGLE'S REAPING MACHINE.



OGLE'S REAPING MACHINE.

SIR,—In the year 1822 I made a small model of a machine for reaping corn, but not being a workman in that business myself, and being on very friendly terms with one Thomas Brown, a founder, in Alnwick, and his son, Joseph Brown, I presented it to them; they made a better model of it than I had made, of iron, and presented it to the public many market-days at Alnwick, thinking to carry it into execution by subscription, but were disappointed—the farmers considered it an impossibility. Thomas and Joseph Brown then made the machine at their own expense, and tried it first near Alnwick: it did not, however, altogether answer, the teeth of the frame, DD, where the knife cut upon (as hereafter described) was too long, and collected the dirt among the corn too much. They then made the teeth shorter, and tried it again at a place called South Side, near Warkworth, in a field of wheat: it then cut to great perfection, but still not laying the corn into sheaves, the farmer did not think that it lessened the expense much. Mr. Brown took it home again, and added the part for collecting the corn into a sheaf, GG, when he tried it again at Alnwick in a field of barley, which it cut and laid out in sheaves extremely well. Messrs. Brown then advertised, at the beginning of the year 1823, that they would furnish machines of this sort complete, for sheaving corn, at the beginning of harvest, but found none of the farmers that would go to the expense, though the machine was seen even to cut the lying corn where it was not bound down with new rising green corn. Some working people at last threatened to kill Mr. Brown if he persevered any farther in it, and it has never been more tried. It was estimated, from what was tried, that it would cut, at an easy rate, fourteen acres per day. For the encouragement of farmers and mechanics, I here give the following account of this machine.

Description.

DD, the frame which the knife acts upon.

EE, the knife that acts upon DD.

BBBB represent the frame on which the machinery is fixed, with the shafts for a horse.

CC, an axis which turns round in the frame at OO.

AA, &c. are the wheels which are fixed fast upon the axis, turn round with it, and give motion to all the other parts of the machine.

DD is a frame, of iron or wood, with teeth in it about three inches long.

EE is a knife which acts upon that frame a little upon the teeth.

YYY, an instrument fixed upon a centre upon a frame at M, turns upon it, and acts in the teeth of the wheels, AA, &c.; leaving the cog of the wheel on the one side and catching it on the other, keeps the knife sliding and cutting out and in, in a very quick motion.

FFFF is a rake that goes round by a belt or chain, upon two pulleys or wheels, and lashes the corn backward upon the knife; it is just eight small iron bars or rods placed in a circle, in a cylindrical form.

GGGG, a platform, made of thin deal or tin, made to go on hinges on the back of the frame that the knife acts upon, and collects the corn as it is cut; this frame is lifted till as much corn is collected as will be a sheaf, and then let fall by a lever, *hh*, over a fulcrum upon the frame, BB, &c. where the corn slides off, when it is a little raised again. It was found, however, to answer better when it was put off by a man and a fork towards the horse, as it is easier bound, and leaves the stubble clear for the horse to go upon.

I have only given a part of the framing, as most mechanics take their own way of fixing the main principles.

I am, Sir,

Your most respectful well-wisher,

HENRY OGLE,
Schoolmaster.

Renington, near Alnwick,
Northumberland.

RESULTS OF A METEOROLOGICAL JOURNAL, FOR OCTOBER, 1825.

Kept at the Observatory of the Royal Academy, Gosport, Hants,

BY DR. BURNEY.

		Inches.			
Barometer	Highest	30.53,	October 15th	—Wind	N.W.
	Lowest	28.97,	19th		N.W.

Range of the Mercury............ 1.56.

	Inches.
Mean Barometrical Pressure for the Month	29.969
——— for the Lunar period, ending the 11th inst.	29.916
——— for 14 days, with the Moon in North declination	29.960
——— for 15 days, with the Moon in South declination	29.873
Spaces described by the rising and falling of the Mercury	7.270
Greatest variation in 24 hours	0.710
Number of changes	22

Thermometer	Highest	71°,	October 6th	—Wind S.
	Lowest	35	20th & 24th,	N. & N.W.

Range..................................36

Mean temperature of the external air 54.74

——— for 30 days, with the Sun in Libra ..57.18

Greatest variation in 24 hours..............20.00

Mean temperature of spring water at 8 A.M. .. 55.01

DE LUC'S WHALEBONE HYGROMETER.

	Degrees.
Greatest humidity of the Air	100 in the evening of the 12th.
Greatest dryness of ditto	53 in the afternoon of the 21st.
Range of the Index	47
Mean at 2 o'clock P.M.	67.6
——— 8 o'clock A.M.	75.1
——— 8 o'clock P.M.	81.4
Mean of three observations each day, at 8, 2, and 8 o'clock	74.7

Evaporation for the Month .... 2.550 inches

Rain in the Pluviameter near the ground . . 3.025

Rain in ditto 23 feet high 2.680

Prevailing Winds, N.W.

A SUMMARY OF THE WEATHER.

A clear sky, 3½; fine, with various modifications of clouds, 11½; an overcast sky, without rain, 10; rain, 6.—Total, 31 days.

CLOUDS.

Cirrus,	Cirrocumulus,	Cirrostratus,	Stratus,	Cumulus,	Cumulostratus,	Nimbus,
21	12	31	1	20	25	18

A SCALE OF THE PREVAILING WINDS.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Days.
2½	0		2	6	5	5	10	31

This month has been alternately wet and dry; the first part was warm for October, but the latter part very variable in the temperature and state of the atmosphere. A sudden fall of the mercury in the barometer took place on the 18th and 19th inst. during a hard gale from the west, accompanied with cold rain, which was followed by showers of snow and hail in many parts of the country to the northward. It is remarkable that this transition in the state of the weather occurred soon after the disappearance of the comet, but we cannot attribute the change to that circumstance, as the same kind of weather would have happened had it been present, with the exception of a little difference in the temperature of the atmosphere; besides, the *minimum* temperature of the external air was three degrees lower in the months of October 1817, 1819, and 1824.

The 20th and 21st were very cold days and nights; the difference between the *maximum* temperature of these days and the 6th was 26°. Several nights in the latter part of the month were frosty, with prevailing strong winds from N. and N.W.

The mean temperature of the external air this month is two one-fifth degrees higher than the mean of October for the last nine years. The temperature of spring water has been very nearly at a stand this month, having deviated only one-twentieth of a degree, and it is two degrees higher than at this time last year, in consequence of the solar heat having penetrated many feet below the surface of the earth in July.

At noon of the 11th inst. the last flock of swallows, about 40 in number, left this place, and in their flight took a S.S.E. direction. This year they remained 26 weeks, which is longer than they usually stay by two or three weeks.

The atmospheric and meteoric *phenomena* that have come within our observation this month are 38 meteors, one of which was very large, and fell, apparently, over Portsmouth Harbour, between 8 and 9 o'clock in the evening of the 15th, sheet lightning in the night of the 10th; and 8 gales of wind, or days on which they have prevailed, namely, one from the N. one from the E. one from the S.E. one from the S. two from the W. and two from the N.W.

THE CLOCK WITH ONE WHEEL, OR, RATHER, WITH NO WHEEL.

SIR,—The failure of your Correspondent of Royston, in his endeavours to construct a clock similar to that described by B. P. C. is one instance in a thousand that must forcibly strike the mind with the great importance and manifold advantages likely to accrue from the present Institutions established for the purpose of teaching the mechanic the first principles of the sciences, whereby he may combine theory with practice on every occasion that may be required.

Numerous instances might be adduced where much time, useless ingenuity, manual labour, and, in some cases, ruinous expense, might have often been prevented, had but the artisan better understood the laws of nature, and their application to the different branches of the mathematics; he would then have been able to reason from cause to effect, and by that means to ascertain, in his own mind, whether any mechanical project, if executed under certain limitations, would be likely to produce the desired effect.

In the present instance, had the *journeyman carpenter* understood the nature of falling bodies, he would have seen at once, that, from the nature and construction of his machine, the cylinder would not descend with an uniform velocity, but, on the contrary, with an accelerated motion, though not exactly the same as a body falling freely in space; for the velocity in the latter case is to that in the former in the same time, as the distance of the centre of percussion from the point of suspension is to the distance of the centre of gravity from the said point. And as this ratio is constant in the same body under present circumstances, we therefore see that the cylinder will unwind from the cord, through the whole of its descent, with a velocity always increasing, the same whether it contain water or not.

But, surely, J. C.'s clock would be more simple, or at least more elegant, if he removed the wheel and put the cylinder in its place. The cylinder thus situated, and having the proper stops or partitions, with a due proportion of

water, must have a fine catgut or string supporting a small weight, suspended in the same manner as is practised with our common clocks, by fixing one end of the line to the board supporting the clock, and the other to that end of the axis of the cylinder round which it is intended to coil when the clock is wound up. The weight must be so adjusted, by trial, as to cause the cylinder to make one complete revolution in twelve hours. Now, if an index be fixed to that end of the axis of the cylinder which is made to pass through the face of the clock, J. C. will, in this case, have a machine that will show the different divisions of time with tolerable accuracy.

A clock thus constructed may be made to go seven or eight days, and, with a little contrivance, even as many weeks, without requiring to be wound up, which, from the ingenuity of J. C., he will readily perceive without any further hints.

I may just observe, however, that the water to be used on this occasion should be distilled, or pure rain water; for otherwise, if spring water be employed, the earthy particles which it holds in solution would in time subside, and might choke up the holes, and finally stop the motion of the cylinder.

I am, Sir,

Yours respectfully,

T. SQUIRE.

Epping.

P. S.—What B. P. C. considers air-holes, are those which are for the water to pass through : the opening near the arbor is left for the purpose of admitting air to the several cells. The small holes for the water to pass must be exactly of the same size, and the cylinder of a uniform weight, or otherwise its motion will be unequal. On further consideration of this subject, I am of opinion, that, if quicksilver were used instead of water, and the number of partitions considerably increased, this clock might be made to keep time with great accuracy; and, moreover, not only the hours, but, with the addition of a few wheels, the minutes and seconds might also be shown. I was going to say more, but I am fearful, Mr. Editor, I have already tired your patience and that of your readers; therefore I will leave off for the present. T. S.

LOCOMOTIVE ENGINES.

The strides which steam is making in the economy of the country, are more gigantic and surprising than those who are domesticated at a distance from its immediate operation probably imagine. But a few years ago, a man would have been thought crazed, who should have talked of a locomotive engine travelling with ease and safety with a weight of *ninety tons* in its train, at the rate of eight miles an hour; and yet the practicability of doing so has been fully proved by the opening of the Darlington and Stockton Rail-road. The following details will exhibit its powers still more conspicuously :—

The engine will travel over the 25 miles seven times a-day, making 175 miles a day's work, with 90 tons, consuming seven tons of small coals each day, or 42 tons per week; which, at an average cost of 7*s.* will be 14*l.* 14*s.* One man and a boy in constant attendance, supposing the 24 hours equal to three days, will be three men and thirteen boys each day, at 16*s.* 6*d.* will add 5*l.* 3*s.* 6*d.* making the total weekly expense 19*l.* 17*s.* 6*d.* The engine will cost 600*l.*, 80 waggons 900*l.*, giving 1500*l.* for the entire *set out.*

Now, 90 tons will load six boats; each of these boats will be a day in performing 20 miles; therefore 52 boats, with 52 horses, 52 men, and 52 boys, will be required to execute the transfer of 90 tons 175 miles in one day; each horse will cost weekly a guinea, each man a guinea, and each boy 12*s.*, forming a total weekly charge of 140*l.* 8*s.* in lieu of 19*l.* 17*s.* 6*d.* The 52 boats and horses will be worth 10,000*l.*, and requiring a considerably greater amount to keep them in repair; throwing a balance of full 7000*l.* per annum in favour of every locomotive engine that may be used. How many may eventually be at work it would be difficult to conjecture; but as 40 would be required to work the London, Birmingham, and Liverpool, and the Manchester and Stockport lines, in all probability not less than 500 would be employed; and, as the saving on every five engines would

be equal to the interest of one million, the 500 would put the people yearly in possession of a sum as great as the interest of one hundred millions sterling, independent of the advantage of speed, and of the great saving of tonnage, the rail-road lines being one-third shorter than the canals in use. Finally, 1000 persons may be conveyed one mile, or one person 1000 miles, by locomotive engines, at the rate of eight miles an hour, at a cost of something less than *five pence*.

A SIMPLE METHOD FOR DETERMINING THE VELOCITY OF BALLS, ETC.

BY MR. W. SHIRES,
Mathematical Tutor.

Place the gun parallel to the horizon, and at a measured distance from it a board or plank perpendicular to the horizon, the top of which is to be of the same height with the gun; now measure from the top of the board to the place where the ball strikes it; then, both measures being in feet, divide 16 feet 1 inch by the distance from the top of the board to where the ball strikes, and take the square root of the quotient, which multiply into the distance betwixt the mouth of the gun and top of the board, will give the feet per second of time, viz. the velocity, including atmosphere, or nearly; by dividing four times the distance betwixt the gun and board, by the square root of the distance which the ball strikes below the top of the board; which methods arise simply from the equation of the common parabola.

EGYPTIAN MODES OF DYING.

In Egypt they produce coloured figures on garments in a remarkable manner. They first rub into the white cloths a liquid application, not of colours, but of drugs, which absorb or fix colours. [Probably they do not use blocks, but apply their mordants by means of a brush or pencil.] When they have done this, it does not show upon the cloths; but these being plunged into a caldron of dye, in a boiling state, are immediately after taken out coloured, *i. e.* with coloured figures or patterns upon them, as the word *pictus* always denotes when applied to any article of dress. It is remarkable, that though there is only one colour in the vat or caldron, it produces several different colours in the garment, being changed according to the properties of the drug which receives it, nor can it be afterwards removed by washing.

APPLICATION OF THE SLIDING-RULE TO STEAM-ENGINE CALCULATIONS.

SIR,—Being a constant reader of your valuable work, and seeing several examples given to measure various pieces of timber and other things, on the common carpenter's slide-rule, I was in hopes some one of your able Correspondents would have given an explanation of the best method of ascertaining the power of steam-engines by the aforesaid slide-rule before this time; but not having seen such a thing from an abler hand than mine, I here send you my method, which I have generally found correct. Say, for example, what diameter of cylinder is required for a 20-horse power steam-engine? I draw the slide of my rule, and set unit on C to 5—3 on D (5 inches and 3-10ths being, as generally allowed, the diameter of an one-horse engine), I look along the slide for 20, and against 20 on C I find 23¾ on D, the diameter required for such engine.

Another example.—What is the number of horses' power (by the same rule) of an engine with a 60 inch cylinder?

The slide being set as before, stated at 5—3, I look along the rule for 60; but that scale ending at 40, and the number of horse power 57, I draw the slide to the other end, and set 57 on C to 4 on D, and then look for 60, and find, against 60 on

D, 128 on C, the number of horses' power required.

If any of your able Correspondents can give a more ready and correct method of calculating the strength of engines than the above, and will do so through the medium of your Magazine, they will confer a favour on many, as well as your humble servant, J. H. B.

A Young Engineer.

Birmingham.

MOYLEY'S TRIGONOMETER AND DUNKIN'S ANGLEMETER.

Sir,—In your Mechanics' Magazine for October 1st, 1825, I observe the invention of an instrument claimed by Mr. M. P. Moyley, of Helston; the chief parts of which are evidently the same as one called a Goniometer or Anglemeter, an instrument applied to the very same purposes as that described by Mr. Moyley, which has many years been the subject of a patent granted to Mr. Robert Dunkin, of Penzance, for "methods for lessening the consumption of steam and fuel in working fire-engines, and also for methods for the improvement of certain instruments useful for mining or other purposes;" which patent was duly enrolled, and is now my property. Many of these instruments have been sold, and four of them were used on board the discovery ships under Captain Parry in the Northern expedition, as by reference to Mr. Fisher's account of that voyage will be seen enumerated; and lest Mr. Moyley's claim to the invention may be injurious to Mr. Harris, of Holborn, and Mr. Ebsworth, of Fleet-street, who have undertaken to make and sell these instruments, I request you will insert this letter in your next Mechanics' Magazine.

I remain, Sir,

Your obedient servant,

Henry Pinnock

Penzance, Nov. 5, 1825.

CARRIAGE SAFETY BRAKE.

Sir,—I have taken the Mechanics' Magazine from its commencement, and have been very much gratified with the communications of your Correspondents, particularly those that are intended for the safety of travellers in either gigs or four-wheel chaises, and have often ruminated upon their several plans, when it struck me that a brake (so I believe the millers call it), such as is used at many of the wharfs to regulate the crane, might be fixed upon the hinder part of the carriage without any or but little disfigurement, with a handle to extend to the part where the driver sits. Such a contrivance would render the carriage secure when going down hill, and impede the progress of a restive horse. So confident am I of its utility, that were I possessed of a vehicle it should be upon that plan. It would be necessary to have a spring fixed upon the pivot, to keep the hoop or brake suspended a *small* space above the wheel.

Should the above suggestion prove worthy a place in your Magazine, I shall be glad to hear the remarks of others; they will prove a great gratification to a constant reader.

Essex.

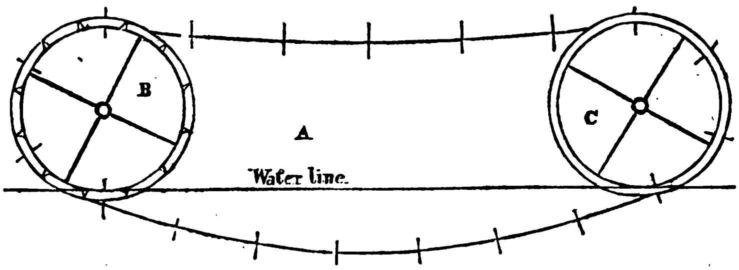
Cheapside, Oct. 19th, 1825.

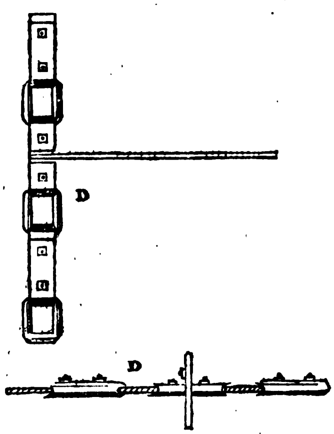
P. S. A thin wooden hoop might be fixed under the iron one, to prevent too much noise.

A QUESTION.

If a mass of matter, equal to that in the sun, was converted into globes of equal diameter to our earth, and placed in the form of a circle in close contact, what would be the diameter of the circle described through the centres of these globes? and how many globes would there be? Trigon.

PADDLES FOR PROPELLING STEAM-BOATS.





SIR,—In the 107th Number of your Magazine there is a Plan for Propelling Steam-boats by means of an endless chain; the principle seems to me to be very good, but I think there might be an improvement made in the chains. In the sketch they seem to be composed of bars of iron, with a joint at each end, and these bars or chains to revolve round an octagon wheel or drum.

Now, Sir, let me lay before you a sketch of another kind of chain, which I think would answer the purpose much better.

The chain is exhibited on the two wheels.

B, the fore-wheel, with studs on the circumference to receive the chains.

C, the aft-wheel, plain on its circumference; both wheels to have a flanch on the outside, to stand a few inches higher than the rim, to prevent the chains from slipping off.

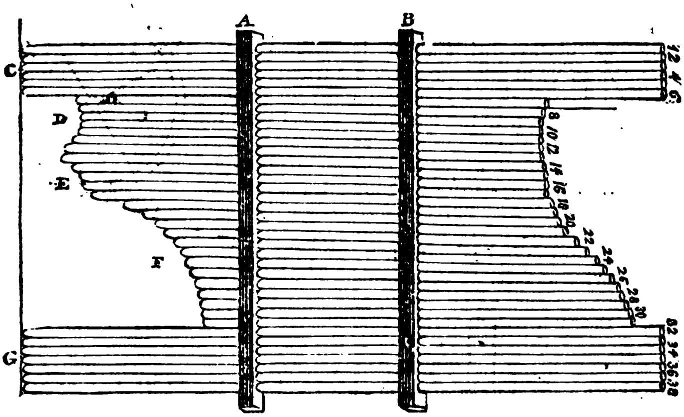
DD, three links of the chain, with one paddle fixed to them. Chains of this sort will work much slacker, and allow the paddles to go a greater depth in the water.

In addition to the above remarks on the improved paddles for propelling steam-boats, I would wish to inform you that I have known the above chains to wear for twenty years, and have no doubt but, by attention and care both in the making and application, they might last for a much longer period of time.

I am, Sir,
Your obedient servant,
A MECHANIC.

Chester, September 30th, 1825.

INSTRUMENT FOR TAKING THE SHAPE AND PATTERN OF A MOULDING.



Sir,—I take the liberty of sending a drawing of a rough model of an Instrument for taking the Shape of a Moulding, which, should it be found deserving a place in your valuable work, may, by falling into abler hands, be so improved upon as to become useful both to the carpenter and to the turner.

Description.

AB are two square pieces of brass, with small holes drilled in them, as near to each other, that when the steel wires, from 1 to 38, are introduced, they may, as nearly as possible, touch each other; then move these wires, 1, 2, &c. up to the moulding, the shape of which you wish to take, as at CDEFG, and then withdraw the instrument altogether, and lay it on a board or on paper, and with a pencil you can draw the shape of the moulding required; and this instrument may be applied in turning two or more vases of the same shape and size with equal ease.

I remain, Sir,

Most respectfully yours,

W. J. C.

Brompton-row, Oct. 27, 1825.

MOTION ON RAILWAYS.

Sir,—Having read a pamphlet by the Editor of the *Scotsman*, in which he sets forth a most extraordinary doctrine respecting accelerating forces, and their effects upon a waggon on a railway, permit me, through your useful miscellany, to state my opinion upon the subject.

Suppose a waggon to be so constructed as to be impelled by a wheel within it, somewhat like a treadmill, and upon this wheel a man were to be placed to give motion to it. Suppose the weight of the man's body to be 200lbs., and that the weight of 100lbs. were sufficient to put it in motion; it is evident that there would be a surplus, or disposable power, of 100lbs. to accelerate the machine; therefore, according to the *Scotsman*, the motion could be increased, in time, "beyond any assignable limit."

This I do not deny, providing that the man could increase his speed in the same ratio, without increasing his labour; but without this the motion would be uniform, and com-

mensurate with the utmost speed the man could move at in giving it motion.

Now, according to what the *Scotsman* holds, the man's weight would be the power, which only he takes into the calculation, without considering the speed at which he would be obliged to travel, to communicate a given motion to the machine. He supposes the power the same at every rate of motion which at a superficial view it appears to be, as the man's *weight* is the same, at whatever rate he moves; but it is clear that his labour would be doubled, by walking twice as fast, to communicate a double motion to the machine, which is the same as a double power.

My view of the subject is this, that the man being able, with the half of his weight, to give motion to the machine, he has a store of power in the other half to give it what velocity he pleases, or, to speak more correctly, to give it what velocity he can keep pace with. Suppose that, at first, he gives it a velocity of two miles an hour, and the wheel upon which he travels to make the same number of revolutions as the wheels upon the rail-road, and of equal diameter, it is evident that he would travel at the rate of two miles an hour; but if he increases the motion to four miles an hour, it is also evident that he must travel at the same rate; therefore his exertions are doubled, or the power expended (though in the same space of time) doubled. To suppose otherwise, would be to suppose an effect would be produced without a cause.

I can readily agree to the result of Mr. Roberts's experiments, but the reasons adduced from them appear to me quite erroneous. They prove only, that the force of traction is nearly the same at *all velocities;* but this does not prove, that though a horse draws much the same, when moving at six miles an hour, that he does when moving at three, that the power expended is the same, as the half of the power is lost in keeping up with the machine.

One circumstance was entirely left out of the calculation in Mr. Roberts's experiments, viz. *the friction of the great wheel* upon which the model was placed. It would have been found, if attended to, that the friction was doubled when the motion was doubled; or, in other words, it required double the labour to keep it in motion. Therefore, though the traction of the model was the same at all velocities, the friction of the great wheel indicated the power expended.

The experiments of Vince and Coulomb, when properly applied, came to the same conclusion.

I am, Sir,

Your most obedient servant,

N. H.

Tweed-side.

EXTINCTION OF THE SUN.

Sir,—In the 113th Number of your Magazine, page 8, I find an article (copied from the *Leeds Intelligencer*) on the periodic time of the Moon, in which it is stated, that "a Mr. Baines has proved, on the principles of gravitation, that if the Sun should be annihilated, the moon would continue to revolve round the earth; but instead of performing its revolution in 27 days, 7 hours, 43 minutes, and five seconds, it would then take 48 days, 21 hours, 50 minutes, and 3 seconds, to perform the same." Now, Sir, I cannot lay claim to much knowledge in astronomy, but I think that every one who knows any thing at all of the solar system, must be convinced of the inutility of such speculative pursuits as this, which are, in fact, a waste of time to no purpose. The sun annilated! Why, what would then become of the earth, or the moon, its attendant? The sun, it is well known, is the grand source and centre of light, heat, motion, and gravity or attraction, to the solar system; and the mind shudders at the contemplation of the dreadful consequences that would attend its annihilation. It would be to every inhabitant of the planets in this system as the awful voice of the archangel, proclaiming "that time shall be no longer." But to pursue the subject as far as our feeble capacities or

stretch of knowledge will admit of (if my ideas of attraction and repulsion are at all correct); the earth would then cease to run her course, rejoicing, in her circular or rather elliptic orbit, but would fly off in a right line through the immense abyss of immeasurable and darkened space; and the coldness consequent on the withdrawing of the sun's heat would congeal every liquid, every thing containing moisture, every animated being (man himself), in one solid, immoveable mass of ice; and the moon, as the earth's attendant, having also lost the "solar action," would doubtless partake of her fate. Annihilate the sun, indeed, and the moon still to continue her periodic revolution! As well might one remove the moving principle from the most perfect and powerful piece of machinery (the steam-engine) that the genius of man has ever invented, and still expect to see it perform its regular operations. Take away the piston from the cylinder, the fulcrum from the lever, the axis from the wheel, or the pendulum from a clock, and although the machine may still continue to vibrate for a time with a slower and a slower motion, from the impulse which it had before received, yet soon shall its functions cease—totally cease for ever.

Annihilate the sun, and you destroy the whole solar system. The planets are all dependent on him—they cannot act at all without him. His attraction confines each in its proper orbit, and sustains the harmony of the whole. He is the moving principle in this the Creator's most perfect, most wonderful machinery of the universe. In a word, whenever (if ever) this event shall happen, then

"Will the silver cord be loosed, the golden bowl be broken, the pitcher be broken at the fountain, and the wheel be broken at the cistern."

"Should the sun or the light be darkened, in that day shall the keepers of the house tremble, and the strong men shall bow themselves, and those that look out at the windows be darkened."

"Then shall man go to his long home; the dust shall return to the earth, and the spirit to God who gave it."

I will not occupy any more of your pages upon this speculative subject, but I cannot avoid expressing my regret, that so much talent should be so uselessly employed. I can compare it to nothing so aptly as the vain pursuits after the "perpetual motion," or the "philosopher's stone."

I am, Sir,
Your old subscriber, &c.
T. J.

Hammersmith.

SINGLE-WHEEL CLOCK.

Sir,—In your valuable Magazine, Number 76, page 319, there is a description of a Single-Wheel Clock, an article I have long desired to be in possession of, but have two great objections to the one therein described. First, because it only shows the hours; and, secondly, because a friend of mine in the country had one of the very same kind, and would never keep time within one hour and a half in twelve hours: but I am happy to say, Sir, that I am certain of having my desires gratified, as I have, through the medium of a friend, been favoured with a sight of one newly invented, which shows the hours and minutes, and can also be made to show the seconds; and I have no doubt that these clocks will keep the most accurate time. There is something peculiarly interesting in this new invention; first, the neatness and elegance with which they may be made; secondly, the curious contrivance adopted for distributing the power equally; thirdly, the singular action applied to the dial-work, to keep the hands going correctly; lastly, that any person can take them to pieces, and put them together again in a few minutes; in short, Sir, I am free to confess, that I have not seen any thing that has gratified me more for some time past. But I must not be too liberal in giving a description, as I am informed by the inventor,

that he intends, at the request of several of his friends, to exhibit it for public inspection.

I am, Sir,

Most respectfully yours,

S. T.

PREPARING DRAWING PAPER.

BY MR. CONDER.

Reduce to a powder, and dissolve quickly in a glazed earthen vessel, containing cold water, some gum adragant, having been well worked with a wooden spatula to free it from lumps. There must be a sufficient quantity of water to give to this diluted gum the consistence of a jelly. Paper, and some sorts of stuffs, upon which, if this composition be smoothly applied with a pencil, or a brush, and dried before a gentle fire, will receive either water or oil colours; in using water colours, they must be mixed with a solution of the above gum. This cloth or paper, so prepared, will take any colour except ink. When it is intended to retouch any particular part of the drawing, it should be washed with a sponge, or clean linen, or a pencil (containing some of the above-mentioned liquid); if the part is only small, it will then rise quickly, and appear as if re-painted.

FIRE-PROOF WOOD.

Doctor Fuchs, member of the Academy of Science at Munich, is said to have discovered a composition by which he renders wood incombustible; the composition is made of granulated earth and an alkali. To obtain this composition, the inventor says, you must dissolve some moist gravelly earth, which has been previously well washed, and cleared from any heterogeneous matter, in a solution of caustic alkali. This mixture has the property of not becoming decomposed by fire or water. When spread upon wood, it forms a vitreous coat, and is proof against the two elements. The Building Committee of the Royal Theatre have twice publicly tried the efficacy of the composition on two small buildings of six or eight feet in length, and of a proportionate height; the one was covered with the composition, and the other built in the usual manner. The fire was put equally in the two buildings; the one which was not covered with the composition was consumed, whilst the other remained perfect and entire. The cost of this process is very insignificant compared to its great utility, being about two francs three centimes per 100 square feet.

The royal theatre at Munich has undergone this process, having about 400,000 square feet; the expense of which was about 4 or 5000 francs.

SIMPLE MODE OF DESTROYING SMOKE.

A Correspondent of the *Birmingham Chronicle* says—"Many years ago, I had occasion to make a number of experiments, on an extensive scale, on the evaporation of liquids, and in one of these a large boiler was covered with boards, and a communication made between the covered space and the flue of the chimney, so that the steam might be drawn up by the heated air and the smoke. One effect produced was the complete destruction of the smoke, and scarcely any steam issued from the top of the chimney. A small boiler, which might be heated by the flue from the main boiler, or, when necessary, a very small pipe from the engine-boiler, to throw a quantity of steam into the chimney, would perfectly prevent the neighbourhood from being annoyed by the clouds of smoke, as is now the case. I have sent the above for insertion in your paper, that the world may not be pestered with patents, in a matter where every man who has an engine may be his own chimney-doctor."

DISCOVERY IN NUMBERS.

A mechanic of Greenwich is said to have discovered a curious property of Numbers, by which a person may be taught in about one hour to square dimensions, and make the most complicated calculations.

ON A DIGEST OF THE PLANS OF SHIPS IN THE BRITISH NAVY.

BY MR. JOHN MAJOR,

Foreman of His Majesty's Dock-yard, Chatham; late of the School of Naval Architecture.

[From the Annals of Philosophy.]

Among the many plans that may be had recourse to for attaining a knowledge of the principles of naval architecture, it has appeared to me, that none is so likely to produce the desired effect as a Digest of the Plans of Ships in the British navy. By this is meant an analysis of their forms and equipments, and a comparison of their elementary compositions with the sea service of the ships.

To speak more particularly, I think the following elements of every seagoing ship in the British navy, if calculated, and generally made known, would throw more light on this subject than any courses of experiments on resistance, on models of ships, or than any theoretical deductions alone, though conducted by the first-rate mathematical genius. They are, the Channel service, foreign and light displacements, or the weight of the whole ship when fitted for Channel service, foreign expeditions, and the weight of the hull; the principal dimensions, viz. the length on the load water line, breadth and draught of water; the areas of the load water plane and midship section; the place of the centre of gravity of the displacement, or its distance from the load water line and the middle of the length of the ship; the centre of gravity of the ship and its contents, obtained by an experiment, which is here appended; the height of the metacentre at the mean height of ports out of water; the length of masts, and size of the sails, so that the whole surface of canvas, set with different strengths of wind, might be seen, together with the centre of effort of such sail; the weight of the metal on each deck, of the masts, rigging, ballast, water, and provisions; the moment of the guns out of water, or their weight multiplied into the distance of their common centre of gravity from the water, which is the best criterion of their force. The force of stability at 10° of inclination ought also to be calculated by Atwood's method, and it would serve in the experiment for finding the centre of gravity of the ship. Analytical research might be carried further than this at a more advanced period of naval architecture in this country, and ought to be; but at present, perhaps, the above outline should not be exceeded. When the analysis is interesting, Dr. Inman's calculation for ascertaining the form between wind and water to make the ship revolve round a longitudinal axis ought to be applied.

By documents in use at the Navy Office, the dimensions of the ships, of their masts, and the number of guns and men, with the draught of water, and an incorrect statement of the tonnage, are already officially noted. The accounts of the ships there obtained are, however, from the infant state of the science of naval architecture in this country, not very minute, or adequately descriptive. It is impossible for one person to obtain by private calculation enough data to guide him sufficiently in designing ships, yet nothing more than what is stated is the result of official duties.

Although much has been done by the present naval administration in introducing scientific knowledge into our dockyards, by the appointment of the students from the School of Naval Architecture to offices in them, yet it has not become the official duty of any one officer to be concerned in the theoretical construction of ships. It therefore happens, that the above elements recommended are by no means generally known, some of them not at all, and most of those supposed to be so, imperfectly: the error is, therefore, as bad as ignorance; and hence has arisen the practice of building from foreign ships.

As the British navy contains ships of all nations, the investigation proposed would go far to exhibit a comparison generally of ships. It might be desirable also to obtain an analysis of some of the latest French and Amecan ships, both merchant and martial.

In October, 1821, I submitted the above plan to the Honourable Navy Board, and they did me the honour to approve of it, by consenting to the execution of it by myself only, on account of economy. As the work, however, is sufficient for the physical exertions of six mathematicians for four years, with the requisite assistance of labour from the dockyards, such an approbation was abortive. It was announced to me in October, 1822, "that it was not considered necessary to prosecute the work any further at present." The object I had principally in view was to derive a theory of vessels from facts; in addition to this, it would afford correct official data for computation, and a navy which costs 15,000,000*l.* sterling in every ten years, would have its construction founded on accurate estimates. I have ardently pursued the study of the subject since, and in consequence do not hesitate to state, that the Government would save by it more than the value which the execution of the plan would cost, besides raising the dockyard service of the navy in scientific competition with that of foreign powers.

Colonel Beaufoy and Mr. G. Harvey, of Plymouth, a few months ago, in the Annals of Philosophy, recommended a course of experiments on resistance, as the only means of extending our knowledge of the scientific construction of ships. So strongly did the latter assert the necessity of it, that he said, "all was darkness and uncertainty without it." It is my opinion, however, from the little advantage hitherto derived from such courses, and the difficulties of applying what knowledge could be obtained from them to ships, that it is by no means a promising track of pursuit for a theory of vessels. The maximum of the power of carrying sail must be united with the minimum of resistance, and both with the weight of hull, pitching, and rolling qualities, &c. When we consider the paucity of knowledge applicable to ship-building, arising from the efforts of the splendid constellation of genius that pursued the subject of the resistance of fluids in the French Academy for twenty years (from 1770 to 1790); the results of the ardent application of the Society for the encouragement of Naval Architecture, in making ten thousand experiments for the same branch of knowledge; together with the failures of several other distinguished bodies and individuals:—our expectation from the institution of another course of experiments on resistance ought not to be very sanguine. To obtain the theory of resistance, seems to be more in the department of a national learned body, as the resolution of a fine physical problem in mathematics, rather than as a work to be depended on for improvement in ship-building.

If we can ascertain the force or moving power of the sals acting at the *point velique*, or resultant of the resistance, we may note a hundred formal experiments on resistance in every ship that goes to sea; and this I believe it possible to obtain to a very near degree of approximation, probably as nearly as in any regular experiment on a model.

Again, if we have the resistance at a given velocity of a ship, which may be obtained by swinging a ship in a stream, and measuring the pull, we have the power of the sail acting at its centre of effort when this ship sails on the ocean with such a celerity as the given motion.

Ships sail on different lines of bearing; therefore the best form for resistance in one direction is not likely to be that in the other. The maximum of the power of carrying sail is also to be united with the minimum of resistance. The smallness of the ship for expense and saving of timber, the working by pitching and rolling, and the weatherly qualities, are all to be blended and properly considered in a ship. And this, it appears to me, can be only developed by the analysis of facts, and critical methods of comparison. In this manner a generalisation of principle would soon, on a little study, occur to a reflecting mind, and facts would check the speculating fancies which have hitherto been the principal ground for the different forms of ships.

(*To be continued.*)

CARTMELL'S IMPROVED PERCUSSION LOCKS.

A patent has been taken out by Mr. Thomas Cartmell, of Doncaster, gun-maker, for an improved Percussion Cock, to be applied to Percussion Locks, 'by which the priming is rendered wholly impervious alike to the rain, wind, or damp.' The patentee specifies three methods for effecting this purpose. The first is for the application of single percussion balls each time that the piece is primed; the other two are for self-priming from small magazines of these balls.

The machinery of the locks is the same as for common percussion locks; the improvements of the patentee being confined to a little apparatus placed on the top of the cock, which, except immediately beneath this part, is not different from a percussion cock of the usual form.

In the first method a small cavity is made in the front of the cock, sufficient to hold a single percussion ball, which cavity is placed so as to fall upon a point projecting from the lock, called here the "striking peg," through which the touch-hole is drilled into the cavity of the piece; one of the small percussion balls is put into this same cavity, either by hand, or by a charger, each time that priming is required, where, if not prevented, it would be liable to fall out, and to be spoiled by wet; but, to preserve it from these accidents, the patentee has contrived a little cap that shuts over it from above, which is fastened to the hinder part of the cock by a hinge or joint, where a small knob projects from it, against which a thin spring presses, that runs up the back of the cock, to which it is fastened at its lower extremity by a screw, the use of which spring is to keep the cap fixed in its place, either when shut down, or when entirely raised. As the front of the cap lies exactly before the percussion ball when shut down, in order to raise it out of the way of the percussion, when the cock is let go, a sloping "cheek" projects from its inner side, which, in the descent of the cock, strikes against a piece that projects for that purpose from the side of the lock, that by the action of the inclined plane of the cheek produces the desired effect; the cock then passes on, holding the percussion ball entirely uncovered, drives it against the striking peg, and ignites it by the percussion.

The second method, in addition to the cap above described, has a small magazine, like a flat thimble, that fastens on the top of its fore part by a dove-tailed slide, with a hole in its lower part, near the front, through which a single percussion ball only can fall at once into a small receptacle prepared for it in front of the cock. To prevent the rest of the balls from falling out when the cap is raised, a thin flat spring, that lies on the top of the cock, passes below the hole through which the balls fall when in that position, and closes it until the cap is put down; which motion removes the hole from over it, and again leaves the passage open.

These different relative positions of the spring stopper, and of the front of the cap, are effected by merely having the joint of the cap at the back of the cock placed about half an inch lower down than the fast end of the spring, by which means the cap, in being raised by its sloped cheek, is also pressed back along the front of the spring stopper; and again in being shut down passes forward over it, so that the hole in its front goes entirely beyond it, and leaves the passage for the percussion balls unobstructed.

In the third method there is no moveable cap, but the magazine for the percussion balls is fixed directly on the front of the top of the cock, and close beneath it a small square bolt passes through the head of the cock from the back to the front; near the front of this bolt is a hole, through which the balls pass, one at a time, to a small receptacle beneath, in the front of the cock, by which it is conveyed to the "striking peg," as in the other methods, when the cock is let go; at which time the

bolt is pressed back, by a part that projects from the lock for that purpose, so that the solid part of it comes beneath the opening of the magazine, and prevents all communication between it and the receptacle; the bolt is again restored to its first position, when the cock is raised by a spring that lies flat against the back of the cock, whose upper part acts on the bolt, and lower part is fastened to the cock by a screw.

To keep the small percussion ball in the receptacle, another spring is placed at the side of the head of the cock, directly below the bolt, having a triangular head, which closes up the front of the receptacle when the cock is raised; but, as soon as it is let go, the side of the triangular head farthest from the spring comes in contact with the side of the striking peg, which, by the action of the inclined plane, moves it to one side, from before the percussion ball, and leaves the latter exposed to the top of the striking peg, against which it is forced immediately after, and ignites the charge.

The Repertory of Inventions, while it applauds the first of these inventions for its simplicity, and being least liable to accidents of explosion, adds—

"It appears to us also, that the magazines have no certainty of delivering the balls, as the patentee states; but that, on the contrary, they would be very apt to obstruct one another in their descent, so as not to be made to come down without taking off the magazine to free them, to which accident they would be peculiarly liable in damp weather, which would more or less affect the chlorite of potash, or other explosive salt, in their composition, so as to make them somewhat adhesive at their surfaces; for though the cap defends the percussion balls well against rain, it could not protect them from atmospherical moisture, which must penetrate wherever the air has any access."

NOTICES TO CORRESPONDENTS.

"A Builder," "N. P." and "A Subscriber," complain of the refusal of the retailers of Mr. Redmund's Patent Hinges to give a reference to the maker. We must refer them for redress to the ingenious patentee, who resides (we believe) at No. 59, Greek-street, Soho.

Norfolciencis guesses rightly—'twas indeed

—— a stranger! lead him forth!
Sandy M********e of the North,
Tom Coriat of the Frozen Zone,
Who saw *what he has seen alone.*

Pursuits of Agriculture.

Sandy has confessed the imposture, and is penitent.

We shall willingly give a place to such further explanation as F. M. may consider necessary.

Communications have been received from T. B.—J. S. Cornwall—A. B. C. —W. K. M.—A Mechanic—Experimenter—A Drummer—W. Downs—Groewoden—Cæsar Borgia—A Young Inquirer—Flint—Monitor—R. O.—F. M. —T. M. B.—Tyro—Nella—Mr. Ogle—Studioso—W. T.

**** Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills, Jowett,* and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

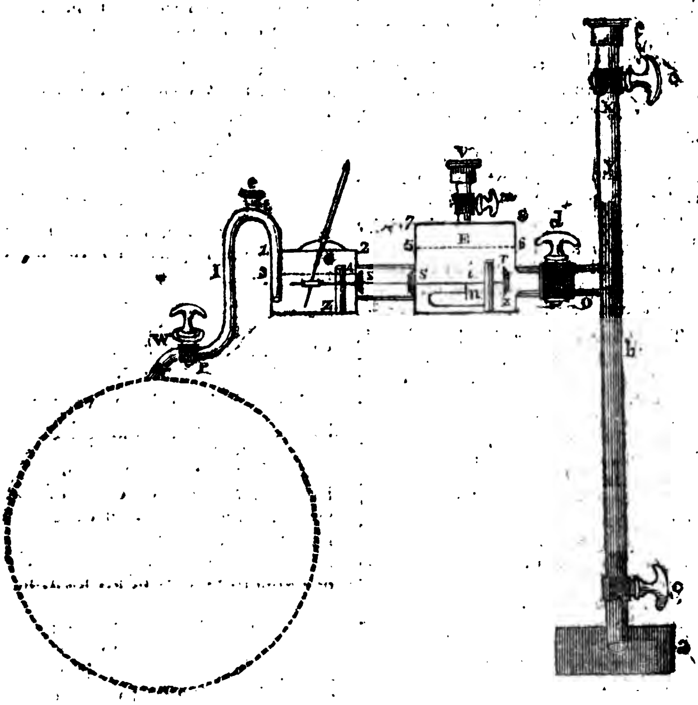
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 117.] SATURDAY, NOVEMBER 19, 1825. [Price 3*d*.

"Those who have particular callings ought to understand them; and it is no unreasonable proposal, nor impossible to be compassed, that they should think and reason right, and better than others, about what is their daily occupation."—*Locke*.

METHOD OF FORMING A VACUUM WITHOUT STEAM OR PISTON.



METHOD OF FORMING A VACUUM WITHOUT STEAM OR PISTON.

SIR,—The idea which the following sketch and description will explain, was suggested in consequence of a Lecture on Pneumatics, lately delivered before the Mechanics' Institution in this town. Should you consider it in any way approximating towards solving the *grand problem* yclep'd Perpetual Motion, its insertion will oblige a subscriber and occasional Correspondent,

J. O.

Manchester, Oct. 1st, 1825.

Description of a Method of forming a Vacuum without employing either Steam or Piston, and without Friction.

a is a small iron vessel, nearly filled with mercury.

b is a tube or cylinder of iron, 31 nches distant between the cocks, *cc*; the lower end of the tube is inserted in the vessel *a*.

The tube, *b*, is connected by the pipe, *o*, to two vessels, E and G.

On the pipe, *o*, there is a cock, *d*, which must be closed; the vessels, E and G, are then to be filled with mercury by the cock, *m*, up to the levels 1, 2, and 5, 6, on both vessels.

The valves, SS, are to be closed by the lever, *k*; and the large vessel, E, is to be filled with mercury by the cock, *m*, and the cap, *v*, screwed on to exclude the external air.

The lower cock, *c*, in the tube, *b*, being closed, the tube, *b*, is to be carefully filled with mercury by the upper cock, *c*, and the cap, *f*, screwed on. The lower cock, *c*, being opened, the mercury in the tube, *b*, will descend, forming a vacuum, *xy*, and standing at its barometric height. The syphon, I, being stationary, is to be filled with mercury by the pipe, *t*, having a valve, which is closed by screwing on the cap, *e*. The top of the vessel, E, is some distance below the barometric range in the tube *b*. The cock, *d*, is then to be opened, forming a communication between the vessel, E, and the tube, *b*; if the cock, P, on the end of the syphon, is then opened, and a quantity of mercury be allowed to run out, equal to the space in the small vessel, G, 1, 2, 3, 4, the valves, SS, attached to the sliding bar, *i*, are then to be moved by the lever, *k* (the sliding bar works through holes in the upright, *zz*). The valve, *r*, being closed, will prevent any air getting into the tube, *b*: the valves, SS, being opened, part of the mercury contained in the large vessel, E, will descend into the small vessel, G, and the space in the large vessel, E, that was occupied by the quantity of mercury discharged into the small vessel, G, will be a vacuum. The valves, SS, being now closed, and *f* opened, the vacuum in the large vessel will be filled by the pressure of the atmosphere forcing the mercury up the tube *b*.

The vessels, E and G, may be filled alternately by shifting the valves, SS and *r*, by the sliding bar, *i*, and lever, *k*. There is a spring, M, having a small pressure to close the valve, *r*. On the cock, P, there is a circular plate, graduated for the index, W, to regulate the quantity of mercury discharged in a given time on a small overshot wheel with buckets, which wheel, by the addition of some very simple machinery, gives a slow vibratory motion to the lever, *k*. As the three valves do not weigh more than two ounces, and sliding in a horizontal direction through holes in either steel or iron, upon which it is evident the friction may be considered as nothing, the friction of the machinery necessary to work the lever may be overcome at pleasure, considering the specific gravity of the mercury; and the power may be increased by merely enlarging the valves, without adding to the friction required for raising the mercury.

SAFETY JACKET FOR SHIPWRECKED SEAMEN.

SIR,—I have been very much pleased at finding, in your valuable Magazine, several communications respecting the preservation of the Lives of Seamen in cases of Shipwreck. The subject is of the greatest importance, and one which claims the highest regard from every friend of humanity; for, of all men, mariners are the most exposed to danger, and when in distress, there are few sufferers who so seldom meet with relief. Besides which, it must be acknowledged, that to this country the services of no class of men are more valuable than the labours of

those who are engaged in transporting her merchandize to almost every part of the world. My present object is to submit a method to the consideration of ship-owners, masters of vessels, and seamen, which, if adopted, will, I trust, prove a means of preserving the lives of many of our fellow-creatures.

The power of effecting escape from the dangers of shipwreck, in my opinion, should always be placed, if possible, in the hands of those on board. How often do we hear of the crews of ships perishing on different parts of our coasts, where no life-boats are stationed, and where no persons could be found capable of affording assistance! When ships strike and break up on a lee-shore, in such situations there is little probability of many lives being saved; the only chance then left for the seamen is, to cling to the drifting fragments of the wreck, and this expedient is frequently found both uncertain and dreadful; for often are they obliged to relinquish their grasp, by reason of their strength being exhausted, when only a few oars' length from the shore.

These melancholy catastrophes have long called for the invention of some power to enable crews in such situations to reach the land in safety. Several plans accordingly have been proposed, but none of them, I think, equal to that of the "Marine Cravat," lately brought forward by your ingenious Correspondent, Mr. Bell. The one, however, which I shall offer, differs a little from his. I am not certain that it would be found more useful.

Let two large bladders be placed between the cloth and the lining of every seaman's jacket, one on each side, with the necks of both of them upwards, that they may be inflated with air the more readily; the mouths of the bladders to be left to appear through a small space in the lining, and the cloth and the lining to be sewed together in such a manner as to prevent the bladders moving from their proper places. In another convenient part of the lining I would have a small pocket made, for the purpose of containing either a metal or a bone tube, to inflate the bladders with, and a few short pieces of thin cord, to tie up their mouths. When the bladders were filled with air, which would be effected in about two minutes, the person might descend into the water; and if the shore were not rocky, there would be great probability of the sufferer's life being saved.

The great and peculiar advantage which, I conceive, would arise from the adoption of the above plan, is this—that seamen would always carry about their persons, without being much encumbered by it, a very probable means of securing their own safety in cases of shipwreck, where the preservation of life is not found impossible.

I remain, Sir,

Yours respectfully,

A Member of the Derby Mechanics' Institution.

BATTERSEA MILL—MEMOIR OF THE INVENTOR, CAPTAIN STEPHEN HOOPER.

Sir,—In Number 109, page 399, of your interesting Miscellany, a Correspondent has called the attention of your readers to the beautiful Horizontal Mill at Battersea. This circumstance has revived in my mind some pleasing recollections of the years that are past, when I numbered the inventor of that ingenious piece of mechanism among my most valued and excellent friends; and it has also suggested the idea, that a short memorial of him and some of his inventions might not be unacceptable to the readers of the Mechanics' Magazine.

The mill at Battersea was built under the direction of the inventor and patentee, Capt. Stephen Hooper, a native of Sandwich, in Kent. He was brought up to the sea, and for many years commanded a West Indiaman, chiefly in the Antigua trade. During his voyages he was in the habit of amusing his leisure hours in mechanical employments, and, like some of your Correspondents, was once so certain that he had disco-

vered the perpetual motion, that, at dinner-time, he declared that he would not take ten thousand pounds for his invention, but before bed-time he had discovered that it was not worth that number of farthings. In his horizontal mill he found more solid advantage; for having left the sea, and built a mill of this kind at Margate, he and his sons carried on for many years an extensive business in the flour trade.

Though the horizontal mill is certainly a very ingenious contrivance, and probably allows of the application of wind, as a moving power, to a greater extent than any other machine; yet it has the same defect in its structure as the water-wheel, to which its interior bears a strong resemblance.

There is a considerable loss of power in consequence of the floats, or, as Mr. Hooper called them, the flyers, moving before the impelling force, and, therefore, being acted on according to the *relative*, and not the *actual* velocity of the wind. Few of these mills have been erected, probably owing to the expense of so lofty a structure; which, if not built with very great care and skill, like that at Battersea, will be extremely liable to injury.

There were other inventions of Captain Hooper, which have rendered this most excellent and ingenious man a benefactor to the mechanical and manufacturing part of the community. He was the inventor of those vanes for wind-mills which contract or extend the clothes in proportion to the increase or diminution of the wind. The same object has since been accomplished by means differing from those he employed, but the thought and exetion were originally his.

But there is another invention of Mr. Hooper's, which has been introduced into almost every piece of machinery whose moving power is subject to changes affecting the velocity of the engine.

When Mr. Hooper first entered on the mealing business, it was esteemed necessary to have a man to superintend every pair of stones, and to adjust, by the screw, their distance, according to the ever-varying motion of the wind-mill. Though not yet well acquainted with the niceties of the flour manufacture, he was convinced that this service might be performed more accurately and more economically by the mill itself. It was, however, long before he could accomplish his object; accident at length led to the completion of his wishes. Walking in the neighbourhood of Ramsgate, he picked up a stone, and having tied it in the corner of his handkerchief, he was amusing himself by giving it a rotatory motion parallel to the horizon, when he observed that, in proportion to its velocity, it endeavoured to extend its orbit, and to rise to a level with his hand. This immediately suggested the idea of the *flying balls*, which not only answered the purpose sought by Mr. Hooper, but have become an almost universal regulator of motion in every species of machinery. The discovery would probably have been productive of considerable pecuniary advantage to him, had he not been most dishonourably deprived of his patent by a counter claim to the invention, advanced by a person resident in the same place; and who, I was told, was afterwards discovered to have bribed one of Mr. Hooper's workmen to allow him to look through the key-hole of the private room, in which was situated the regulator that governed the five pair of stones in the horizontal mill.

In the time of scarcity which occured about the year 1801, Mr. Hooper met with some very unpleasant circumstances, from the unquiet spirit which is always manifested by John Bull when he is either hungry, or fears he shall be so. On one occasion, it was only by the prompt exertions of a body of cavalry that Mr. H. and his family were preserved from destruction. Upon this he offered the use of his mills to the Magistrates for the convenience of the town, but declined business on his own account, as having become both unprofitable and dangerous. Shortly after this he sold his property at Margate, and went to reside at Walworth, near

London, where for some time he pursued his mechanical amusements, and formed many very ingenious and interesting models, which, from his situation and time of life, he never had the opportunity of applying to any useful purpose. He died at a very advanced age, leaving, in the breasts of all who knew him, a most pleasing remembrance, not only of his mechanical genius, but of the more important qualities of ardent piety and genuine benevolence.

To return to the horizontal mill. Your Correspondent has very accurately represented the internal mechanism, by comparing it to a large water-wheel, whose shaft is perpendicular to the horizon; but if he will more clearly inspect the exterior, he will find his idea relative to the "semi-cylindrical case revolving about the same axis" quite erroneous. The exterior is a circle exactly similar to a *Venetian blind*, each shutter being capable of being brought into contact with its neighbour, so as to exclude the wind entirely; or of being so opened as to admit a full breeze to fall upon the flyers, or floats of the internal wheel. It is evident that one side of this structure will admit the current of air, while the other will be impenetrable; and that this will be the case, let the wind change in any direction whatever. By a very ingenious contrivance, Mr. Hooper at first enabled the mill to regulate its own velocity, by closing or opening the shutters as the wind increased or diminished its force. But as this machinery was apt to get out of order, he discontinued the use of it in his own mill, and left the regulation of the speed to the vigilance of the workmen.

I am, Sir,

Your obedient servant,

Q.

P.S. The mill at Margate has recently been pulled down, after having been materially injured by the heavy gales to which it was exposed, from its elevated situation on the cliff.

THE INVENTION OF MR. M. P. MOYLEY'S "TRIGONOMETER" INVESTIGATED.

SIR,—In the year 1807 (some 18 years ago), I had the superintendence of an embankment on the sea-shore, which was about three miles long, the making of which was set in some dozen jobs; I had to carry a heavy and an unweildy implement great part of the time, to lay out and ascertain the correctness of the slopes at the back and in front of the embankment along that line; having also an occasion to lay out the slopes of the principal drain different from any of the other slopes, I began to consider the best method to connect all these slopes in a *portable* instrument.

Perusing Messrs. W. and T. Jones's Treatise on the Description and Uses of Mathematical Instruments, an idea struck me, *exactly similar to the instrument attributed to Mr. Moyley's invention,* which I proposed to be of the length of one foot; I used a *foot rule* for a model of it, with a brass quadrant divided on one side into degrees, with a nonius on the upper limb of the rule to measure the intermediate quantities of the angle, and with a spirit-bubble on the upper limb (same as that marked C in Mr. Moyley's description); it answered all the purposes of a theodolite, to take angles beneath the level or horizontal position of the instrument. On the other side of the brass quadrant was the *proportional* angle for measuring and laying out slopes and declivities.

This contrivance being laid upon a twelve-foot rule, which is to be found generally on any part of an extensive undertaking, the slopes are measured, or laid out, with great exactness, the result of which then gave me great satisfaction.

Subsequent to that time I became a land-surveyor, in the outset of which business I felt the same perplexity in reducing hills to the measure of their base, which is indispensable, where the hilly surface interfered with the correctness of the survey. I then applied another spi-

rit-bubble to the lower limb (in order to elevate the upper one to the angle of the surface which was to be reduced), and marked on the side of the brass quadrant the difference in links between the length of the base and the length of the surface or hypothenuse line, which enabled me shortly to form an idea sufficiently accurate for the purpose of making allowances in these cases, without any other aid.

I have since applied it to various other purposes, in this *and other shapes*, for taking angles of inaccessible declivities, slopes, and sections. This simple instrument I used to call my "Sector;" but, to my mortification, about ten or eleven years ago, the late Mr. Turner, of Whitchurch, laughed at me, saying, "that I had made use of another man's invention; and if I called upon him in Whitchurch, he would show me one which he had made use of for some years." This I had not an opportunity of doing while he lived; I have, however, ceased, since I received this information, not only to publish the instrument as my *own invention*, but I actually gave up exhibiting and using it, and it has now been mislaid for some years.

Without wishing to wound the inventor's feelings, and genius of Mr. Moyley, I have, however, felt it necessary to state these facts; and without wishing to intrude myself any farther upon your undertaking,

I am, Sir,

Your most obedient servant,

O. D. Owen.

Shrewsbury, Nov. 7th, 1825.

P.S. The outer rim of the quadrant was racked, and acted upon by a milled thumb-screw, to make the movements as easy and as accurate as possible.

BRITISH HERBARIUM.

Sir,—I have long been a great admirer of your very useful periodical, to which I acknowledge myself indebted for several portions of household knowledge of much service. In return, I feel anxious to contribute something that may further the great and important object you have in view, which is, the improvement of the large population of mechanics in their acquaintance with the various arts and sciences.

As a young member of a profession, I am somewhat at a loss how to do this with the greatest advantage, particularly as that profession (the medical) is one, the practical part of which ought not, in my opinion, to be made known too indiscriminately to those who are incapable, from various circumstances, of understanding its principles; and to whom, therefore, a knowledge of its facts, from want of knowing their proper application, would prove rather injurious. Having, however, for some time past, devoted what leisure time I could command to the study, practical and theoretical, of Botany, I would willingly contribute such knowledge as I may have acquired to the improvement of any portion of the community whom it may be likely to benefit; and should it, Sir, meet your approval, and should it accord with the intentions of the Mechanics' Institution, I will occasionally communicate to your valuable publication such facts, connected with our indigenous plants, as may be likely to prove serviceable to the arts; and I will, moreover, in order to facilitate the study of botany to those who may be induced to cultivate it, send to the Institution specimens of all such plants as I can with certainty make out, dried and preserved in the best manner I am able, so as to exhibit at one view both the generic and specific character of each; and to these I will append their technical description, time of flowering, place of growth, &c.

Should these proposals merit your approbation, I have no doubt but that you may meet with scientific Correspondents in other parts of the kingdom, who will furnish such plants as may be peculiar to their neighbourhood; so that, in process of time, the Institution will be put

in possession of a complete indigenous Herbarium, the very great utility of which every practical botanist must subscribe to.

Many articles, derived from the vegetable world, which are used in the various arts, and for which we depend upon our foreign trade (consequently procuring them frequently adulterated, at a high price, and, in time of war, very irregularly), may be found to exist, I have little doubt, in our own native plants.

Medicine, and the art of dyeing (not necessarily connected, as some would insinuate), may, I conceive, be particularly benefited by the more extended study of practical botany. It will be totally unnecessary to say more upon a subject which must be so obvious to every one.

I am, Sir,

Your hearty well-wisher,

PHILO-BOTANICUS.

Kimbolton.

P.S. Could any of your numerous Correspondents give me any useful hints respecting the preparing dried specimens of plants? The method I pursue, is simply to place them between the leaves of large heavy books, superimposing a weight larger or smaller, according to the substance of the plant.

[We have communicated the liberal offer of our Correspondent to the Managers of the London Mechanics' Institution, and we are requested to say, that they feel gratified for his offer, and will make arrangements for the due preservation of whatever specimens he may forward to them. The laudable desire of our Correspondent to co-operate in the improvement of the mechanic classes, has taken a most beneficial direction.—EDIT.]

THE QUESTION OF SPECIFIC GRAVITY.

SIR,—I have not seen a solution, at present, to the question of Trigon, (page 415, vol. IV.) and should you not be furnished with a better, perhaps you will make room for the following.

It is almost needless to premise that the weight of the quantity of water, displaced by any floating body, is equal to the weight of that body; thus, if a cylinder floating upon water sunk to its centre, or had half its substance out of water, it is very clear that the bulk of water displaced by half the cylinder would be equal to the weight of the whole; dividing, therefore, the bulk of water displaced by the bulk of the body under experiment, we should then have $\frac{1}{2}$, or, in decimals, the specific gravity would be .5: by the proposed question 3-11ths of the circumference was dry. To find what proportion a cylinder will be divided into by a plane cutting the surface in the ratio of 3 to 8, may be solved by the usual rules of mensuration of solids. In the first place, it may be convenient to find the number of degrees in the smaller segment: 11 : 360° : : 3 : 98° 2-11ths, the half of which is 49° 1-11th; the sine of which, multiplied by the cosine, will give the area of the triangle = .4949 to be added to the area of the greater sector, and which is readily found, being 3.14159 8-11ths = 2.2848, adding to this last number the area of the triangle, or 2.2848

.4949

total immersed 2.7797

This last number, divided by the bulk of the cylinder, or 3.14159, gives .885 for the specific gravity nearly.

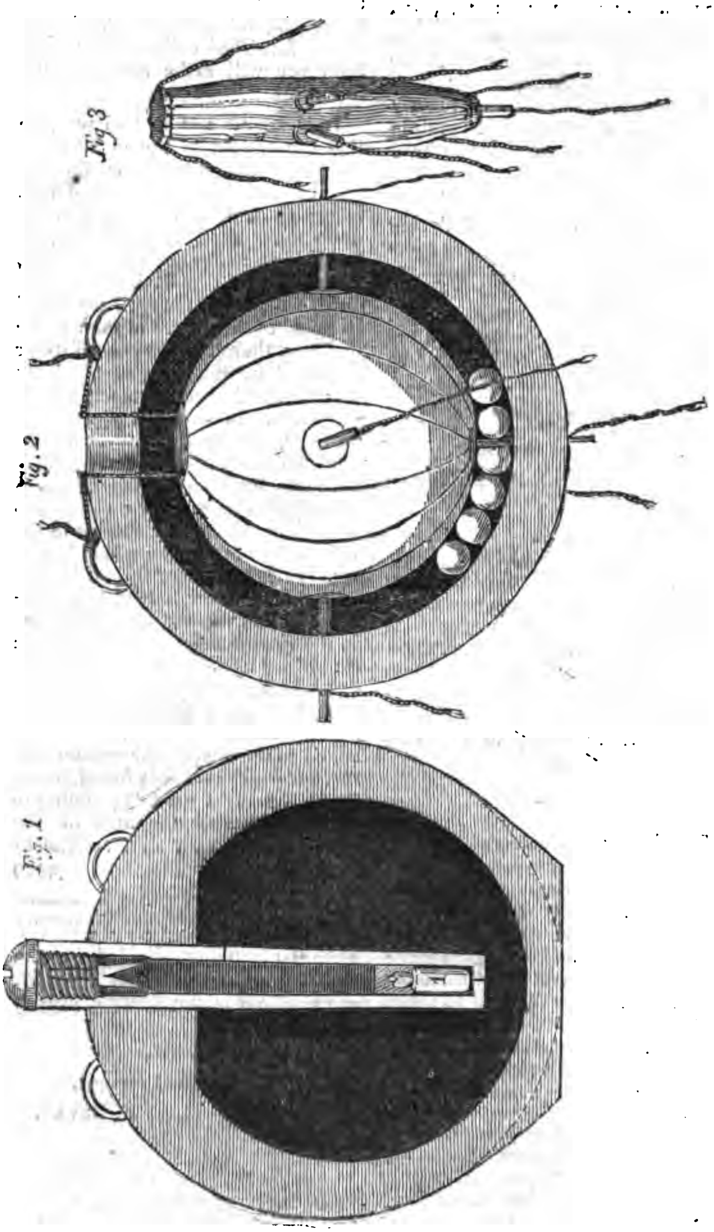
I am, Sir,

Your obedient servant,

B. BEVAN.

DESCRIPTION OF TWO NEW SHELLS,

INVENTED BY MR. WILLIAM SPENCER.



DESCRIPTION OF TWO NEW SHELLS, INVENTED BY MR. W. SPENCER.

Sir,—I beg to forward to you, for insertion in the Mechanics' Magazine, sketches of two shells, &c.

I am, Sir,
Your obedient servant,
Wm. Spencer.

11, Ordnance-place, Chatham.

Description.

No. 1.—*Section of a Shell and Fuse (projected* 1811), *to explode when it meets with resistance.*

1. Flint set in lead.
2. Steel fixed in the screw.

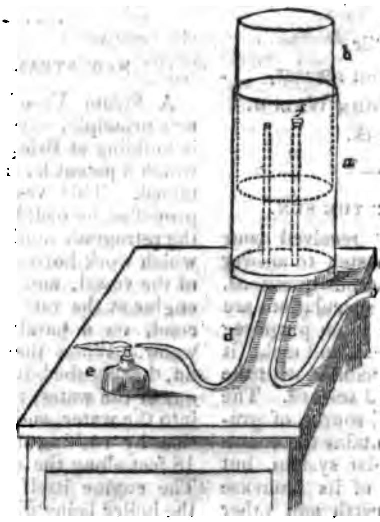
The fuse to be driven into the shell without either flint or steel, and the shell placed in the mortar; the flint then put in and a little fine powder with it, and then the screw.

The form of the shell is to ensure the upper part striking the ground or object.

No. 2.—*Section of a Shell (projected* 1805).

A leather or linen ball is placed within it, and pieces of wood threaded on the lines, as shown by the sketch; when put into the shell, the lines to be drawn through the holes, which are drilled or cast in the quarters of the shell, the holes plugged up, and the ball filled with powder, and the cavity with musket balls.

IMPROVED BLOWPIPE.



Sir,—I perceive in the Mechanics' Magazine two ingenious contrivances, to continue and regulate the stream of air from the Blowpipe; but, in my opinion, they will only half accomplish their object, as it is evident the force of the stream will be in proportion to the rise and fall of the water in the adjoining vessel; for when the water is high, the pressure will be great; and when low, very little. I send you a drawing of an apparatus, which, I think, will answer the purpose.

Description.

a is a tin vessel, filled with water to within four inches of the top.

b, another tin vessel, inverted in the last.

c, a tube, blown by the mouth, which runs through the bottom of the under vessel and rises up, having its end an inch or more above the water, where there is a small valve at *f*, to prevent the air getting back again.

d, the blowpipe, which also runs through the bottom of the under vessel, and to the same height above the water, but has no valve.

e, the lamp.

The upper vessel will rise and fall as the air is driven into it, or escapes; and as the tin is of little bulk, it will always be of the same weight, however deeply immersed in the water; and consequently the air will always issue from the blow-pipe with the same degree of force. Small weights may be placed on the upper vessel, if necessary.

I am, Sir,

Your most obedient servant,

John Welch.

Newton, near Alnwick.

EXTINCTION OF THE SUN.

Sir,—I have just received your last Number, and hasten to answer some of T. J.'s numerous questions.

Imprimis.—These speculations are not a waste of time to no purpose; they enlarge the mind, and make it more intimately acquainted with the principles of physical science. The sun is *not* the grand source of gravity; it is true it contains the centre of gravity of our solar system, but that is on account of its immense magnitude. The earth and other planets attract the sun as well as the sun attracts them. Were the sun removed, the earth would, it is true, fly off in a tangent, if we neglect the attraction of the other planets, and the moon and earth would still revolve round their common centre of gravity, which would move in a straight line uniformly. The difference in the periods in the two cases is caused by the removal of the sun's disturbing force; but, taking into account the other planets, the system would revolve still about the common centre of gravity, as any one who has reflected sufficiently on the subject must see.

I remain, Sir,

Yours respectfully,

F. O. M.

Nottingham, November 13th.

[The letter of *Indicator*, on the same subject, being apparently intended rather to show the sarcastic powers of the writer than simply to correct what is erroneous, is (though from a respected Correspondent) declined.—Edit.]

NEW STEAM VESSEL.

A Steam Vessel on an entirely new principle, says a Hants Paper, is building at Bridport harbour, for which a patent has recently been obtained. This vessel is not to be propelled by paddle-wheels, but by the retrograde motion of short flaps, which work horizontally in the sides of the vessel, and are carried by the engine at the rate of 24 feet in a second, on a parallel line with the water. When the flap, or rather fin, has finished its motion, it rises out of the water, returns, dips again into the water, and repeats its operation by rushing through a space of 18 feet along the sides of the vessel. The engine itself is equally novel, the boiler being dispensed with, and the steam generated by forcing water into a double barrel, by the heat of which it is instantly converted into steam, having all the advantages of the perpetual boiler without its encumbrance.

MECHANICS' INSTITUTIONS.

A Mechanics' Institution has been established at Armagh, which is the more remarkable and gratifying, that Armagh may be considered as *the Irish capital* of High Church, or, in other words, *Anti-Mechanic* prejudices. It has been established, however, in the teeth (as might be expected) of a most bitter opposition; indeed, on no occasion have the enemies to the instruction of the people given such plain utterance to their groundless (except in as far as they are *self-interested*) fears and apprehensions as on the present. The Armagh champion of ignorance is a Dr. Millar, whom *The Irishman* describes as "a learned and laborious, yet fantastic philosophical historian."—(Can any body tell us what people he has tried to sink into oblivion by his labours?)—We would give the Doctor's speech a place in our work, but that the insertion of it might be said, by some of our waggish friends, to be converting into a pillory what ought to remain a monument of honest endeavour to better the condition of humanity) we prefer, therefore, laying before our readers the refutation with which the arguments of the Doctor have been *honoured* from the pen of Mr. George Ensor, one of the most enlightened and efficient advocates of the ignorant and poor (poor, because ignorant) which the present day has produced; and this for two reasons, that it states the Apostle of Darkness's arguments most fairly, and refutes them most completely.

The refutation which we proceed to copy is from the *Newry Telegraph*.

"That Mechanics' Institutes will spread in Ireland, I have no doubt. I consider that Ulster will lead the way. To facilitate the business I would advise that no doubts should be entertained on the legality of such meetings, as some Rev. Gentlemen did at Armagh; because, to end the question at once, that Act, among the six Acts to which they alluded, expired the end of last Session. The enemies of the improvement of the people may also avoid condemning the proposal *in toto*, for Charles the Tenth of France, at present, in Paris, authorises mechanics to be congregated to hear lectures on their respective arts; and if this is insufficient to lay the fears of alarmed and Rev. Gentlemen, Mr. Huskisson,* a Cabinet Minister, has expressed his opinion on the prospective beneficial results of such Institutions. The opponents of the advance of society had better assume other grounds for their argument, and other topics for their rhetoric—abuse of the lower orders has been tried and failed. Indeed, it had a counter operation; what some, before this unmanly vituperation, considered merely becoming, strengthened into a point of honour, and thus hate and insolence performed the business of duty and love. Such insulting speeches make many subscribers. Indeed, nothing can be worse than the reasons of these lovers of darkness; I, therefore, in charity, refer them to Noodle's speech, in the last *Edinburgh Review*, or Bentham's Fallacies; and, strange as it may appear to the High Church anti-mechanics, a brother of their own order composed it. Having advised the enemy how to improve their tactics in supporting 'the reign of chaos and old night,' I proceed to our friends.

* "I have no difficulty in stating, that I consider Institutions of this nature as likely to be attended with beneficial results, both to artisans and to the public, if properly regulated, and directed to those objects to which such institutions ought, in my opinion, to be limited—I mean to the teaching of such branches of science as will be of use to mechanics and artisans in the exercise of their respective trades."

"I would advise them, in advocating these Institutes, not to act as has been conceded by some in Belfast and in Armagh, to exclude all books not scientific—even general history and biography. This will avail them nothing with the lovers of darkness. They will, as at Armagh, turn it to their disadvantage, and call, even an over-anxious solicitude to qualify their fears, a proof of deeper malignity. Depend upon it, my friends, you cannot satisfy them by any submission; for, besides the evils of their system, which necessarily excites all imaginary terrors—'the thief doth fear every bush an officer'—they traffic on the enunciation of terrors which they do not feel. Thus they bring themselves in high sympathy with those who can advance their interests—those who love to hear of dangers in embryo—prospective disorganative agrarian laws—and who pay the terrorists with taking their journals and advertising in them—with placing them in the Excise, and with advances and pluralities in the best possible Church establishment; thus treating those terrorists as children, who give their parents property to old nurses for distracting their waking and sleeping thoughts with stories of ghosts and goblins. Therefore, you, who are about to establish Institutes, must be satisfied that you cannot quiet those traders in alarm. They can only be satisfied by what you cannot give them—places.

"Turning from those to the truly timid, let me say a few words to them. We know the struggle there was to emancipate education—every confusion, mortal and immortal, was prophesied in consequence. Well, the people would be educated; then the object was to render education as imperfect as possible. As in some economical boarding-schools the boys are fed on small soups and hard puddings, in these day-schools the intellectual repast was both dense and watery—

'The ropy drivel of rheumatic brains.'

"So the common enemy proceeded to oppose the Lancasterian schools. Then, when an attempt was made to establish a school in Westminster,* to teach the higher branches of learning by the process already practised in elementary schools, the lovers of darkness were up in arms. What will become of Eton, and Winchester, and Harrow, and Westminster, said they, if the mode and course be so materially changed? Thus a whole people are kept in error and obscurity, lest some score or two of men, as old in their notions as the foundations of their schools and colleges, should be incommoded and forced to improve. And now we have the Mechanics' Institutes assailed, and the promoters of them vilified. All this is one feeling variously expressed.

"Dr. Magee, the Archbishop, is dogmatic on over-educating the people; for ignorance is always orthodox, and credulity beatitude on earth. 'Over-educating,' said the Bishop, 'will make the people uneasy and unmanageable.' We have heard that a little learning is dangerous; but this divine considers that the evil is in its amount. I disagree with both Poet and Bishop. A little learning is good, and more learning is better; but, to use a homely expression, a man must have a mouthful before he has a bellyful. Thus more and most learning is better and best for man, woman, and child. If the working classes improve in learning, the other classes must move forward also, or be overrun; nor can I perceive any reason that, if they continue ignorant, and others become informed, that these should take the lead. If man's mind be his distinctive character, the improvement of that mind is aiding nature, and fulfilling the destination of Providence. Over-education is a

* When the Westminster Improved School was contemplated, and subscriptions had commenced, Sir S. Romilly was requested to apply to a certain Earl, to whom some propose to transfer the Catholic Petition next Session (this is not Earl Grey). "No;" said he, "for it would injure Westminster School." This Sir S. Romilly told to my informant, Mr. Bentham, who said to Sir S. Romilly, "and did you not laugh in his face?"

mere sophistical term—an attempt to assume, in the expression, an evil of knowledge to the people. A man may neglect his labour for his books, and there are such individuals as poor scholars; but, in a national view, let men read as they may, they must first work for their daily bread. Education can never abstract the bulk of mankind from toil; and if, because some are impertinent in consequence of their knowledge, this should exclude the multitude from enjoying all means within their power to improve themselves, foppery in dress should be an argument against broad cloth and ginghams. The knowlege of the people, or, to use Dr. Olinthus Gregory's language, addressed to the Deptford Mechanics' Institute, 'their improvement, to the very extent of their mental susceptibilities, is most healing and generous. It operates on all classes and orders—it promotes universal instruction—it reforms by representing itself—it mitigates bad constitutions, and improves, imperceptibly, laws, manners, and opinions: yet is every advance or proposal to this effect received as a challenge to insurrection—the most lying insinuations are whispered or proclaimed —to instruct the people is reputed a declaration of war, and every progress is made at the hazard of a battle. No wonder that, so beset, and waylaid, and maligned, every partial success to improve the race of Adam should be hailed as an achievement.'

"In the same way, those who could not stop the Armagh Mechanics' Institute, laboured to circumscribe its utility; and those who openly or secretly opposed it, altogether *put a veto* to the admission of books of History and Biography into the library. Precedent was vouched, and Belfast was the solitary authority for excluding such works from such Institutions.* Why should histories be excluded? The Bible is, for the most part, a history; but histories may teach politics; and what history pinches and wrings the vile parts of politics more keenly than the Old Testament? If men are taught to read, they will read, and nothing can be more instructive than histories, particularly biographies of scientific men. There is no possibility to exclude them. The project is as vain as it is absurd. This exclusion began in the Belfast Institute, and incipient in the Armagh Institute, exceeds the vilest order that ever issued from Pope or Prince, and surpasses infinitely every Index Expurgatorius, that ever issued from any holy alliance of bigotry and tyranny. But in this country, such a fundamental prohibition of useful and invigorating knowledge is so stupid that it reaches fatuity. Histories are not to be read in the Armagh Institute that are read in all other Institutes, Belfast excepted. If histories be evil, will this correct the mischief? Will it operate as a new conductor to the charged mass to popular feelings? But still it is right to avoid error, say they. Historical books may excite political aspirations. Well, and is politics a crime? At Athens one not a politician was reputed a bad citizen; while, in our perfect Constitution, a politician is thus an adjudged criminal. Why should history teach politics? Why should politics teach evil, if the laws and Constitution be good? This is to conclude that men are damnable, indeed. But we have not reached the extent of the stupidity of this precaution. Mechanics must not read histories, lest they should become politicians, when newspapers, urging politics, and infuriate as the sybil, day after day, are multiplied among us, making a part of the entertainment in public-houses, and adding a zest to the dram; yet our

* On this point Mr. Ensor appears to have been entirely misinformed. Mr. Lawless, the honest and intrepid "Irishman," observes, in reference to it—"We have great pleasure in being able to inform Mr. Ensor, that the character and feelings of the Belfast Mechanics' Institute have been greatly misrepresented to that excellent Gentleman, and that it is *not* a fact that *a veto is put on books of History and Biography* into the library of Belfast."

mechanics are not to read history in the library of the Mechanics' Institute, lest history should infect them with politics, and politics should make them bad Christians and worse subjects. I know nothing more absurd, not even the imagination, that mechanics should combine against their masters in the library. Addison, to be sure, makes men conspire in Cato's hall of audience against Cato; but mechanics are not poets; when they combine, they act altogether prosaically, and like persons of business.

(To be concluded in our next.)

M. MONNOM'S REPLY TO MR. J. WELCH.

SIR,—It would be more pleasing to me to lay before the public some useful article than to encumber your pages with this; but as Mr. J. Welch seems to consider the machine described by me in the 22nd Number of your Magazine is more calculated to bore cheese than the earth, and it may appear to some people, like Mr. W., unacquainted with the power of machinery or the nature of friction, to be of no other use, I therefore think it my duty to ask Mr. W. what sort of stones his part of the country produces, since they are not to be cut by the rotatory motion of a machine? and whether they are harder when in the bowels of the earth than when they are on the surface? I have never yet met with a stone I could not cut or drill, but never tried the experiment below the surface of the earth. I should think, if the machine could be turned round, it would produce the same effect. Mr. W. seems to object to all rotatory machines for the purpose of boring. If I had bored from my infancy with a hammer and chisel, as Mr. W. states he has done, I would, I am sure, have found out some better contrivance before this day.

If he had not stated that two inches sometimes were a good day's work, one might have imagined, by his commencement, that he would bore through the earth in less time. He recommends to the public a jolting machine; but, if I had thought of nothing better than a jolting machine for the purpose of boring, I should not have considered it as worthy of a place in the Mechanics' Magazine.

Mr. W. or any other Correspondent who will pay me for the experiment, shall be convinced that, if the earth was made of iron or steel, it might be penetrated by a rotatory motion, where the hammer and chisel would fail.

In whatever plans I have or may send to the Mechanics' Magazine, it is a rule with me to investigate and see that they are practical, as I am aware that they are open to the inspection of many, some of whom are more disposed to ridicule the plans of others than to do any good service to the public themselves. If every inventor was to keep back his designs until he could point out the extent of their use, or render them incapable of improvements, few indeed would come before the public. All hints relative to scientific knowledge ought to be acceptable, as we are not obliged to put them into practice without considering their utility or expense; and, however trifling they may appear to some inspectors, still they may be of the greatest utility to others.

I remain, Sir,

Your obedient servant,

M. MONNOM.

Broadway.

SPOT ON THE FACE OF THE SUN.

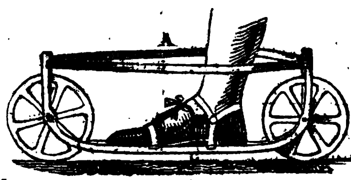
SIR,—I have this day noticed a spot on the face of the sun rather larger than usual, and, from its position, it will probably be visible for six or seven days. I measured the apparent diameter of the spot with a micrometer, and found it about $13\frac{1}{2}$ seconds, at a medium, as the figure is not circular. Now, as the mean distance of the sun is known to be 95 millions of miles, it will be easy to calculate what must be the actual breadth of a body at that distance, to subtend an angle of $13\frac{1}{2}$ seconds. By multiplying the distance into the sine of the angle, it appears the breadth must be more than 6200 miles; or, if a body equal in diameter to $\frac{4}{5}$ths of our world was placed on the surface of the sun, it would only appear of the size of the spot above mentioned to an observer situated at the distance of our planet from the sun. The penumbra, or visible shade, surrounding this spot, had considerably more than double

the breadth of the central spot. It will probably ever remain an interesting object of inquiry to discover a satisfactory explanation of these phenomena of nature; in the present instance, a superficies equal to the whole of Europe and Asia may be considered operating to diminish the effective source of light and heat.

I am, Sir,
Your humble servant,
B. BEVAN.

Leighton, Nov. 9th, 1825.

A VELOCIPEDE.



SIR,—The above is the drawing of a Velocipede, intended to be fixed on one foot, when the *velocipedestrian* pushes himself away with the other. As the wheels are about six inches in diameter, it may be used on any road tolerably smooth; and as the foot is brought near the ground, and is supported by the strap, A, it will not wrench or fatigue the ancle, as the common skates do; the whole body, too, will be as much at liberty as in walking.

The patent "Land-skate" has the wheels directly under the foot, and, from their being so small, it can only be used on a boarded floor, or a place equally smooth.

I am, Sir,
Your obedient servant,
* * * * * *

ANSWER TO INQUIRY.

NO. 164.—RAISING WATER.

SIR,—For the information of your Correspondent, "B." (Inquiry 164, vol. v. of your useful and entertaining publication), I send you the following calculations and dimensions, hoping they may prove to be such as he is in search of.

First, then, $\frac{149800}{18} = 8322,2$ cubic feet per hour, and $\frac{8322,2}{60} = 138,7$ cubic feet per minute. A cubic foot of water weighs 62,5lbs.; consequently $138,7 \times 62,5$ will $= 8668,75$lbs. which is to be raised 33 yards or 99 feet per minute; and $8668,75 \times 99 = 858206,25$lbs. raised one foot high in one minute; also $\frac{858206,25}{33000} = 26$ horses' power, which will be required to raise the given quantity 149800 cubic feet 33 yards high in 18 hours. It must be a double-power condensing engine, with a cylinder 27 in. diam., and a 6-feet stroke, making 16 strokes per minute; but, as the above engine is only calculated to do the given work and no more, I would recommend Mr. B. to put down a 30-horse power engine at the least; he then might calculate upon always

being fully equal to his work; the cylinder must be 29 inches diameter, with a 6-feet stroke, and make 16 strokes per minute. The next thing is the pump; and my advice will be, to put down 2 instead of 1, for, if only 1 is used, it will be very large, as well as the pump-tree. Two working barrels, 11,5 inches diameter, with 6-feet strokes, making each 16 strokes per minute, would lift the proper quantity; but, in order to make sure of a sufficient supply, I would advise him to put in two 12-inch pumps, which would make up for all common casualties, such as the wear and tear of leathers upon the buckets, clacks, &c. The calculations for the pumps and quantity are as follows:—First, $\frac{12 \times 12 \times ,7854 \times 72}{282} \times$ $10,2 = 294,168 =$ number of pounds in one stroke of one pump; and as each pump makes 16 strokes in a minute, the calculation will proceed thus.: $\frac{294,168 \times 32 \times 60 \times 18}{62,5} = 162663 =$ number of cubic feet pumped 33 yards high in 18 hours. Finally, in words, as required per question:

Power of the engine, 30 horses.

Diameter of cylinder, 29 inches.

Length of stroke, 6 feet.

Number of strokes per minute, 16.

Pumps.

Diameter of the barrels, 12 inches.

Length of stroke, 6 feet.

Each barrel, 16 strokes per minute.

Quantity of water per stroke, 28,84 ale gallons, or 294,168lbs.

The two pumps may be worked in a variety of ways, well known to all ordinary mechanics, at least such of them as ever have had any thing at all to do with pumping-engines.

Should Mr. B. wish for any further information upon this subject, and communicate it through the medium of your Magazine, I will (if in my power) endeavour to gratify him.

I am, Sir,

Yours respectfully,

A MAN IN THE MOON.

October 31st, 1825.

NOTICES TO CORRESPONDENTS.

Through an oversight, which we regret extremely, the name of the painter of the original Portrait of Mr. Nicholson, from which the engraving that accompanies our Fourth Volume was taken, was not mentioned. It is the production, we are informed, of an American artist named Bowman; and we think all our readers will agree with us, that it does great credit to his pencil. As a likeness, nothing could be better.

J. B. B.—We shall turn our attention to the subject.

Modestus L**.—We have long had in view what he suggests, and intend shortly to make the attempt.

T. M. B. will please send on Monday next for a communication to him.

Communications have been received from—A Subscriber—H. C——ll—Dixon Vallance—Juvenis—J——s ap S——h—Trebor Dranyam—Indicator—Noslochin—Square—A Young Bricklayer—A Rotherhithe Shipwright—Anvil—B. W. N.

*** Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.
Printed by MILLS, JOWETT, and MILLS (late BENSLEY,) Bolt-court, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 118.] **SATURDAY, NOVEMBER 26, 1825.** **[Price 3*d*.**

MR. CRANE'S INVENTION FOR SAVING THE LIVES OF SHIPWRECKED SEAMEN.

Sir,—I take the liberty of begging a place in your valuable columns, for the purpose of laying before your readers a plan for saving Shipwrecked Seamen, invented by a Mr. Crane, of Norwich. I presume that the sketch scarcely requires an explanation, on account of its simplicity.

Description.

BB are two barrels, of sufficient size to contain 36 gallons, or more.

nnnn are four notches cut in the plank, PPP, to keep the barrel ropes, *rrrr*, from shifting.

The plank should be oak, if possible, 9 or 10 feet long, 2 or 3 inches thick, and about 1 foot wide; under each end of this sail-cloth bags (filled with coal or ballast) should be firmly fastened, to keep the men upright.

This, Sir, is the whole of the plan. The facility with which these articles could be obtained, on board almost any vessel, need not be questioned. I have seen many ships stranded, and many inventions made use of for saving the crews. The rope-gun does not answer on a flat beach; and the life-boat, in many cases, cannot get off, on account of the tremendous surf which such a beach naturally occasions. Where, then, all hope of obtaining a communication from the shore to the vessel has been frustrated, surely Mr. Crane's invention is well worth attention.

I am aware (as Mr. C. himself must be) that the old objection would be started, as usual—that such contrivances tempt the men to leave the vessel before her destruction is inevitable; but, in this case, it would be decidedly to their advantage to stay on deck till she goes to pieces, for they would have the chance of preserving the ship (if that were possible), and saving themselves from being so exposed to the actual sea as they would be on the raft. Surely that is not lost time which is spent in contriving means for saving those men who are labouring for the honour and prosperity of their country; and who but he who has seen the horrors of a lee-shore—who has seen his fellow-countrymen making the bosom of the ocean their dying bed, can refrain from those feelings of humanity which his conscience so plainly sets before him?

As your columns are open to every thing which is "unquestionably correct and good" (when it does appear), I trust that the saving the lives of our fellow-creatures will be held to come under this head.

I am, Sir,

Your most obedient servant,

S. R. C.

MAGNETISM IMPARTED TO IRON BODIES BY ROTATION.

A very curious paper on this subject, by Mr. Barlow, has been read before the Royal Society. Mr. B. having fixed a 13-inch mortar shell to the mandril of a powerful turning lathe wrought by a steam-engine, and caused it to perform 640 revolutions in a minute, the magnetic needle deviated several degrees from the magnetic meridian, and remained stationary during the motion of the shell. When the rotation ceased, it immediately resumed its original position. When the motion of the shell was inverted, an equal but opposite deviation of the needle took place.

When the earth's action on the needle was neutralized, and the needle made a tangent to the ball, the *north* end of the needle was *attracted*, when the motion of the ball was made towards the needle, and repelled when the motion was in the contrary direction, and this happened whatever was the direction of the axis of rotation. In the two extremities of the axis there was observed no effect, but in two opposite points, at right angles to the axis, the effect was a maximum, and the deviation of the needle was to the centre of the ball. In speculating on these facts, Mr. Barlow is disposed to think that the earth's mag-

netism is of the induced kind, and he considers this opinion as supported by the fact of the non-coincidence of the magnetic axis with the axis of the earth's daily motion.

RULES FOR THE CONSTRUCTION OF CHIMNEYS.

Mr. Tredgold, in his work on Warming and Ventilating Apartments, has given the following rule for proportioning the upper orifice of chimneys to their heights and the magnitude of the fire-places :—

Multiply by 17, the length of the fire-place in inches. Divide the product by the square root of the height in feet, and the chimney above the fire. The quotient will be the area of the upper orifice in square inches.

Thus, if the fire is 15 inches wide, and the height of the chimney be 9 feet, we shall have $\frac{17 \times 15}{7} = 36\frac{1}{2}$ square inches nearly, which is a rectangle of 6×6 inches, in a circle of nearly 7 inches in diameter. In chimneys already existing, the upper orifices may be contracted to their proper size by Parker's cement. The contraction of the lower end of the vent above the fire should be nearly the same as the upper orifice; and the throat or lowest opening should not exceed the length of the bars. The length of the front of the fire should be an inch for every foot of the room's length, and the depth one-half the length. If the length of the chamber should be such as to require a grate more than 30 inches long, two fire-places should be constructed.

SAFETY STEAM-BOAT.

A Correspondent of the *Bristol Mirror* concludes an interesting article on the melancholy loss of the Comet, and the dangers to which steam-vessels are exposed, with the following suggestions for the construction of a Safety Steam-boat :—

"Why may not every steam-vessel be constructed and provided as a *Life-boat?* Many ways of doing this will present themselves to those who are conversant with the subject; but the most simple and perhaps effectual is one which the writer of this, several years ago, developed in the *Bristol Observer*, not thinking of its most appropriate application to steam-boats, which, indeed, were not then in general use. This plan consists in dividing the hull of the vessel into three distinct compartments, by firm and tight divisions from side to side, so that should the water gain access to one part of the vessel, it could not penetrate to the next. The objection which was started to this plan, as applied to ships of burden, was, that it would *prevent stowage;* and although it was acknowledged that it might save many ships now lost, yet the objection was held valid. But in steam-boats this objection cannot occur, as they are not built for stowage. The very arrangement of the vessel seems almost to point out the plan. The engine part is detached both from the cabin and the steerage. Let these divisions be constructed as strongly as the side of the boat, and caulked in the same manner; and *though her bow or stern should be completely stove in, she would still float*, and afford ample time to save all the lives on board, and perhaps even be found competent to continue the voyage. Such a vessel might be denominated with propriety a *Safety Steam-boat*, and, if started, would infallibly ensure an ample share of the public patronage."

MECHANICS' INSTITUTIONS.

(*Concluded from page 78.*)

"I would advise, also, all who may meditate the extension of Institutes throughout Ireland to avoid excluding operatives from the Managing Committee. This it is proposed to do in Armagh, as will appear by the report of the resolutions, which is to be submitted to a public meeting in Armagh the first of next December. There can be only two reasons for this unprecedented manœuvre :—First, that working mechanics are not fit to associate,

at any time or occasion, with gentlemen. If Christ lived with operatives—if he confided his doctrine to the dissemination of handicraftsmen—the modern teachers of Christianity, in the provincial towns of Ireland, and their small gentry also, may condescend to meet in a room, for an hour in a month, some half dozen mechanics, in order to forward mechanical pursuits. Nor has the power of mechanics been destroyed in spreading Christianity in these after ages. The present Dr. Cary was, until his 24th year, a working shoemaker. He originated Missionary Societies in the British Empire, the revenue of which approaches nearly half a million annually. And observe who are those operatives who cannot be endured by our gentility—not he who lives in the blaze of the furnace, or who, with his brawny arms, makes the anvil tremble with his strokes—no, an operative includes every manual operator. Thus, by excluding operatives, Mr. Troughton would be excluded, and Dr. Herschell, who was originally a band-boy, and, to the last, polished his own glasses.

"So much for the exclusion of operatives on religious grounds; we now come to the constitutional. The Constitution acknowledges no distinction but the nobility and commonalty. No profession is excluded from Vestries, nor from Juries—none are excluded from the House of Commons. Mark the absurdity; a watch-maker, a cabinet-maker, a paper-maker, is excluded from the Armagh Mechanics' Institute (such, at least, is the proposal)—they cannot be elected by their brother mechanics to a Mechanical Committee, though they might be elected to the Legislature.

"Let us now try the objection by more intimate considerations. A sportsman will associate with grooms and whippers-in, and the dog shall be his parlour companion. Fiddling gentlemen, *il fanatico per la musica*, will sit on a bench, in the world's gaze, with the paltriest tormentors of catgut; they will eat and drink, and catch and glee with them, at the Anacreontic; and, by-the-bye, what would musicians be without mechanics?—whistlers on the Pandean pipe, or thrummers on a tortoise-shell. Again, gentlemen have no difficulty to associate and revel with farmers, "whose talk is of bullocks," and yet some of the higher order refuse—not to eat and drink, and sing to the dawn with mechanics—but they refuse to consult the select of mechanics, much for the same reason that the spruce courtier railed at the soldiers, for bearing a slovenly corpse

'Betwixt the wind and his nobility.'

I have often wondered how those who are verbally so vitally Christian, that to doubt one dogma is to lose heaven, can indulge such reserve and contempt for the working people. I wonder how they consider that matters will stand hereafter. Will they consent to mingle with the throng, and be saved with the multitude, or renounce paradise? for there the operatives will be. 'Go to hell, you dirty hussey,' said one of those followers of Lucifer to a poor old woman, who was curious to see some holiday sight—'go to hell, I say.' The woman replied—'Ah, your honour, the quality would not let dirty me there among them!'

"The other reason for excluding the Armagh mechanics from all participation in the management is, that Armagh affords no mechanics sufficient to serve the Institution by their presence on the Committee. Suppose so; does it become the gentry of Armagh to expose the imbecility of their city?—does it become them to discourage the mechanics of Armagh by this prohibition?—and should they not rather foster and promote their pretensions? But how does it appear that the mechanics of Armagh are so miserably imbecile? In Newport, in the Isle of Wight, with a population of only four thousand people, a Mechanics' Institute has been established, and two-thirds of the Committee of Management are mechanics; yet, in Armagh, the seat of St. Patrick, the residence of the Protestant Primate, of course the focus of the clergy of the establishment, with a population, many of

them opulent, and more than double that of Newport, no mechanic can be admitted into the Managing Committee; because, forsooth, not one of them is sufficient to exercise the pre-eminent and awful responsibility of Committee-man; and this becomes more wonderful, as the mechanics in the town amount to about five hundred and fifty. Are any facts adduced to fix this imputation on the mechanics of Armagh? No. And it is notorious, that a body of mechanics and tradesmen had actually formed themselves into an Institute in the neighbourhood of Armagh, some time since, called the 'Self-improving Society;' yet, in the city of Armagh, where superior mechanics necessarily reside, it is pronounced that not a single mechanic is fit to join a similar society. They who testify so of their townsmen, proclaim their own prejudices, stupidity, and ignorance; and so far are such ignorants from having a right to monopolize the direction of any such public Institution, that they are unworthy of any control in its arrangement and ministry; for such sweeping charges, against so numerous a body of men as the mechanics of Armagh, prove a radical incapacity, in those who make them, to form a correct judgment on ordinary affairs. They have lived without observing, and will die, probably, without the benefit of experience.

"I, therefore, repeat what I mentioned at the beginning of this address, and I call on the independent and zealous friends of Ireland, in Newry, Dundalk, &c., to establish Mechanics' Institutes for the common benefit of the town and country; and in all let the healthy and popular constitutions be adopted, if they are intended to subsist with credit and utility. Such Institutes will bring men of different ranks within the same sphere, and thus restore the true end of orders in society; for they should operate as bonds of concord and strength, and not as disjuncts of separation and enmity. The study of mechanics is good for all. Man has been defined a tool-making animal. Mechanics are of perpetual use and never-ending interest. By them magic and witchery have lost their interest, and tales of Eastern romances are outdone by European facts. In Britain heated water performs the labour of three hundred thousand horses. Thus the greatest effects are produced by the least efforts, and the elements are made subservient to man's will. If such Institutes must be useful and entertaining to the non-operatives, how much more must they captivate and possess those whose maintenance and consequence depend on their ability in arts and manufactures! Those Institutes will at once afford mechanics a repertory to facilitate their knowledge, and advance the character and genius of the nation; and considering what has been done without such assistance, nay, in defiance of all circumstances—Arkwright was a barber, and Nicholson a cabin-boy—we may hope, with such increased resources and opportunities, that this after-age will exceed that which is just past, as that far transcended the preceding period.

GEORGE ENSOR.

Ardress, Oct. 26th, 1825.

Mr. Ensor has since sent his life subscription of ten pounds to the Secretary of the Armagh Mechanics' Institution, withdrawing his name, at the same time, from the Managing Committee, for the reasons signified above.

PASTE FOR SHARPENING RAZORS.

Take a quantity of slate, wash it well, pound it in a mortar, and pass it through a very fine hair sieve; mix some of this powder, first with well water, and afterwards with olive oil, to the consistence of fat. Put some of this paste upon a common razor-strap after it has been properly cleaned, so as to remove all foreign bodies from it. Pass the razor from right to left, as usual, ending with raising the back a little, and a perfect edge will be obtained. —*Edin. Phil. Journal.*

SAFETY GUN.

The Rev. Mr. Sommerville, of Currie, near Edinburgh, has invented a Safety-lock, the merits of which cannot be made too extensively known. The contrivance is extremely simple, and may be made intelligible without any diagram. In the back part of the trigger there is a square notch, into which a thin sliding bar or catch is pressed by a spring, and keeps the trigger perfectly immoveable. The sliding bar is concealed within the plate lying under the guard. A handle attached to the sliding bar stands up in front of the guard, in such a manner as apparently to form a part of it. When the gun is presented in order to take aim, the left hand, by a slight pressure—no greater than is naturally employed in bringing the gun to the shoulder—moves the handle of the sliding bar to catch backward; the catch itself recedes from the notch; the trigger, now unlocked, yields to the finger, and the discharge follows. The security which this affords arises, first, from both hands being necessary to work the gun; second, from the mere placing of the hands in the proper position being sufficient to effect the discharge; and, third, when the two hands are not placed in the firing position, no possible species of accidental contact can make the lock move, or the gun go off. With Mr. Sommerville's lock, the sportsman may travel the whole day with his gun on full cock, with the most complete and entire safety. When he brings his gun home loaded, he has only to screw off the handle of the catch, and though half a score of inquisitive urchins should lay their hands upon the gun, they cannot possibly make it go off.

NEW RAZOR STRAP.

A M. Cheneaux, of Paris, has obtained a patent for the following method of making straps for whetting razors:—Take a piece of common leather, leave it to soak in warm water, and then rub it over with a matter composed of the filings of cast steel, dissolved in aquafortis, made red-hot in a crucible, and pounded to powder. It is stated that this simple composition will, without any sort of mixture with oil or grease, make the strap different from all those hitherto manufactured, and cause it to produce an edge preferable to that given by the hone or the polisher.

TABLE FOR THE CONSTRUCTION OF SUNDIALS.

BY MR. M. SMITH.

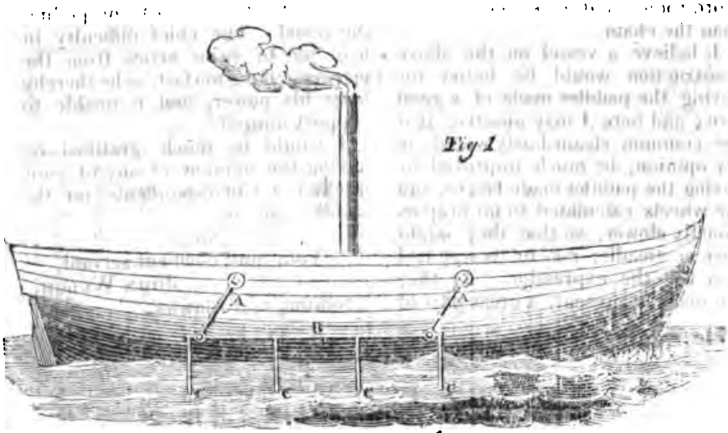
(From the Philosophical Magazine.)

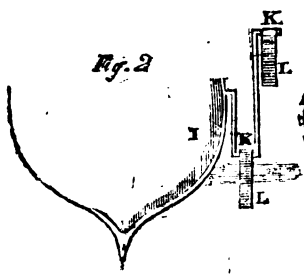
All the tables for the construction of Sundials, which I have hitherto seen, are extremely erroneous, being calculated on the supposition that the shadow is cast from the centre of the sun; and therefore any dial constructed from such tables must invariably err one minute of time from the truth. The following table is computed on the principle that the shadow is cast from a point in the sun's disc one minute of a degree within that limb which is nearest to the meridian, and consequently 15 minutes from the sun's centre. The shadow therefore coincides with the meridian at one minute of time from noon. This remark must be particularly attended to, as it follows that the hour-angle for noon is negative; consequently the upper line in the table, or that standing opposite to 0h. 0m. is to be set off from the meridian in the contrary direction from all the others, which will have the effect of contracting the double hour-line for twelve o'clock, so as to render it somewhat less in thickness than the gnomon or style of the dial.

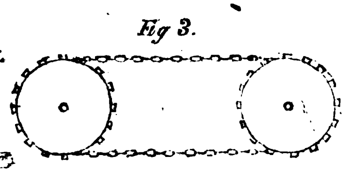
The Angles which the Hour-lines make with the Meridian in a Horizontal Dial, for each Degree of Latitude in England.

Hour from Noon.		LATITUDE.													
		50°		51°		52°		53°		54°		55°		56°	
H.	M.	°	'	°	'	°	'	°	'	°	'	°	'	°	'
0	0	0	12	0	12	0	12	0	12	0	12	0	12	0	12
	15	2	41	2	43	2	46	2	48	2	50	2	52	2	54
	30	5	34	5	39	5	43	5	48	5	52	5	57	6	1
	45	8	29	8	36	8	42	8	49	8	56	9	3	9	9
1	0	11	24	11	34	11	43	11	52	12	1	12	10	12	19
	15	14	22	14	34	14	46	14	58	15	9	15	20	15	30
	30	17	24	17	38	17	52	18	6	18	19	18	32	18	44
	45	20	30	20	46	21	2	21	17	21	32	21	47	22	1
2	0	23	39	23	57	24	15	24	32	24	49	25	5	25	21
	15	26	53	27	13	27	33	27	52	28	11	28	28	28	45
	30	30	13	30	35	30	56	31	16	31	36	31	55	32	14
	45	33	40	34	3	34	25	34	46	35	7	35	27	35	47
3	0	37	13	37	37	38	0	38	22	38	44	39	5	39	25
	15	40	53	41	18	41	42	42	4	42	26	42	47	43	8
	30	44	42	45	6	45	30	45	53	46	15	46	36	46	57
	45	48	38	49	3	49	27	49	49	50	10	50	31	50	52
4	0	52	43	53	7	53	30	53	52	54	13	54	33	54	53
	15	56	56	57	19	57	41	58	1	58	21	58	40	58	59
	30	61	18	61	39	61	59	62	18	62	36	62	53	63	10
	45	65	48	66	6	66	24	66	41	66	57	67	12	67	27
5	0	70	25	70	40	70	55	71	9	71	23	71	35	71	48
	15	75	8	75	20	75	32	75	43	75	53	76	3	76	13
	30	79	56	80	4	80	12	80	20	80	27	80	34	80	41
	45	84	47	84	52	84	56	85	0	85	4	85	8	85	11
6	0	89	41	89	41	89	41	89	41	89	41	89	42	89	42
	15	94	34	94	30	94	26	94	23	94	19	94	16	94	13
	30	99	26	99	18	99	10	99	3	98	56	98	49	98	43
	45	104	14	104	2	103	51	103	41	103	31	103	21	103	12
7	0	108	58	108	43	108	28	108	15	108	2	107	49	107	37
	15	113	36	113	18	113	1	112	44	112	29	112	14	111	59
	30	118	6	117	46	117	26	117	8	116	50	116	33	116	16
	45	122	29	122	7	121	46	121	25	121	5	120	46	120	28
8	0	126	44	126	20	125	57	125	36	125	14	124	54	124	35
	15	130	50	130	25	130	1	129	39	129	17	128	56	128	36
	30					133	58	133	36	133	14	132	53	132	32
	45											136	42	136	21

NEW STEAM-VESSEL PADDLES.







Sir—As the Paddle-Wheels at present used to propel Steam Vessels are universally allowed to be imperfect, from the loss of power sustained by the paddles striking the water in an oblique direction, I make free to send you an invention of mine, which has been lying by me a long time, by which, I think, this inconvenience may be altogether obviated.

AA, two cranks, which both move round in the same time and direction.

B, a beam that connects the extremities of the cranks.

CCCC, the paddles affixed to the beam.

Now it is plain, that as the cranks move together, the beam will be carried round in a horizontal position; and that, consequently, the paddles will always be perpendicular. But as they will be immersed in the water only during half their revolution, their size must be much greater than those on the common paddle-wheels.

Fig. 2 represents a double crank, bearing two sets of paddles, on the same principle, which perhaps would be better, as the resistance to the engine would be more regular. This would not increase the breadth much, as the paddles need be only half the size of those on the single crank.

I is the side of the vessel.

KK, the ends of the beams.

LL, the paddles.

One of the cranks (it matters not which) may be turned by the engine, and motion may be communicated to the other, by having them connected by a chain passing round two wheels, one on the axle of each crank, as is represented in fig. 3.

The same purpose would be answered by having three common cog-wheels placed in a row, the two

outermost being on the axles of the cranks; but they would take up more room, and make more noise, than the chain.

I believe a vessel on the above construction would be better for having the paddles made of a good size; and here I may observe, that the common steam-boats would, in my opinion, be much improved by having the paddles made larger, and the wheels calculated to go proportionally slower, so that they might have a steadier *pull* or *sweep*, if I may use the expression. As they are made at present, a great part of the power is expended in dashing the water into foam, which contributes but little towards propelling the vessel. The chief difficulty in learning to swim arises from the learner *striking* too fast, as he thereby loses his power, and is unable to support himself.

I would be much gratified by having the opinion of any of your intelligent Correspondents on the above; and am,

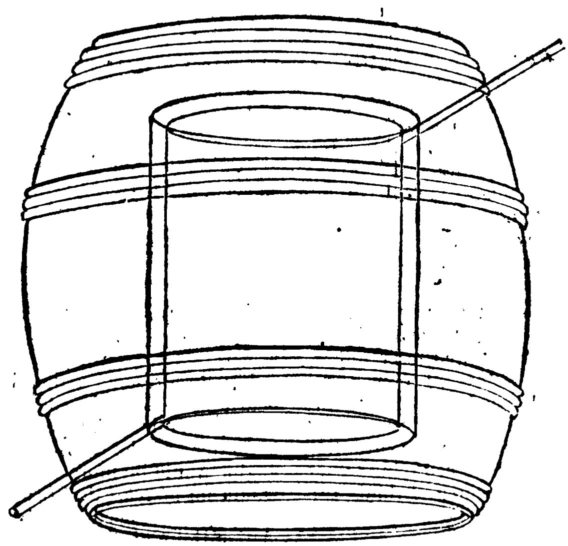
Sir,

Your most obedient servant,

JOHN WELCH.

Newton, near Alnwick.

SIMPLE CONDENSER.



SIR,—I have often thought that many would distil their own mint, and other herbs, if it was not for the expense of a worm, as that is the most costly part of the still. I here send you a plan of a Condenser, which I believe has never been made in this shape before. It is made of tin (copper is better, but I speak for cheapness), and will last many years, costs only a few shillings, and most certainly condenses the steam far better, by exposing a greater surface to the action of the cold water, than the flat one, made in the shape of a book, for which I believe there is a patent.

Make two cylinders, say 18 inches high, and the outermost one 12 inches diameter—the inner one 11 inches, one to go within the other, leaving a clear space between of half an inch all round; close the top and bottom of this space, leav-

ing a pipe at the top for the entrance of the steam, and another at the bottom for its exit when condensed; let it be well soldered and air tight, and when immersed over head in a cask of cold water, I have found it answer the purpose of a worm most completely.

I am, Sir, yours, &c.
C. T——.

Morpeth, Northumberland.

HORIZONTAL WINDMILLS.

SIR,—In the 114th Number of your valuable Miscellany, there is a drawing and description of a Horizontal Windmill by T. T., who probably thinks that the idea is a new one, which, however, is not the case; for, about nine years ago, I made a similar one on a small scale, with this difference, that I fixed a large flat piece on the top of the upright shaft, on which the arms lay, one crossing over the other at right angles, and secured to it with collars, in which they might revolve freely in a vertical direction. The vanes, instead of being attached to the arms with hinges, as T. T.'s, were firmly secured at right angles to each other; or, in other words, if the vane at one end of each of the arms hung perpendicularly downwards, those at the opposite ends would be horizontal, and *vice versâ*. It is therefore evident, that whichever vane catches the wind, it is forced downwards towards the perpendicular, and in that position recedes, and is succeeded by the next; while that at the opposite end of the arm, as before-mentioned, is by the same action borne upwards towards the horizontal, thereby offering but a trifling resistance in advancing to that point where it preponderates, catches the wind, and assumes the perpendicular in its turn.

I applied it to a boat with paddle-wheels, with a view of propelling it against the wind—an object that I have no reason to think unattainable, although it failed with me at that time, owing to the horizontal revolution of the sails giving a tendency to the vessel to wheel round in the water in the same direction; I therefore gave up the experiment, with the intention of attempting it at some future time in another form, by making use of two sets of sails, one over the other, made to revolve contrariwise, by which means the tendency given to the vessel to wheel about by one set, would be neutralized by the contrary tendency given to it by the other. This, though I still think it practicable, is mere theory, as my other avocations have not afforded me leisure sufficient to bring my intended experiment to the test, necessary to form an accurate judgment of its claim to further consideration and improvement.

I am, Sir,
Your very humble servant,
S——.

L—q—p—d-street.

ANOTHER CALCULATING BOY.

From an Irish Paper.

A most interesting exhibition of the power of mental calculation took place on Monday evening, at the Meeting of the Scientific and Literary Society in Cork.

Mr. Hall, Secretary to the Mechanics' Institute, introduced a boy to the notice of the Members, of whom he gave the following account:—

His name is John Flyn; he was born on Michaelmas-day in the year 1814, and consequently has but lately completed his eleventh year; his father is a small shoemaker, residing in Blarney-lane, Cork, and has five other children, none of whom have given intimation of the same powers. This boy has, for the last four years, been educated at the Monastery School, and was considerably advanced in arithmetic before his extraordinary power of mental calculation manifested itself.

Several questions were put to the boy by the members and others present, among whom he created great astonishment by the readiness and correctness of his replies, leaving those who solved the same proposition on slates far behind. He cubed the figures 345, and repeated every

figure of each line of the process, and formed correctly the fifth root of a very large number which had been previously ascertained. He can raise any two figures to the fifth power; and in money calculations he is truly wonderful, finding the interest or discount upon any sum for any number of days, and the number of any smaller supposititious coin that may be contained in any number of a larger description. As an illustration, the question was asked him—How many 2*s.* 8¼*d.* pieces will make 1000 guineas? which he solved correctly in a quarter of a minute by the watch of a gentleman present.

At the conclusion this proposition was put:—Supposing there are present in this Hall 34 ladies, 96 gentlemen, and 28 boys—that the ladies were each to give you 5*d.*, the gentlemen 4*d.*, and the boys 3*d.*, how much money should you receive? The boy was not long in solving this question, though not so quickly as the hint was adopted by those present, who expressed the gratification they had received, by collecting for him the sum of 2*l.* 9*s.* 10*d.*

We trust that the powers thus early displayed by this boy may be turned to some useful and profitable account.

NEW MUSICAL INSTRUMENT.

Mr. Schultz, from Vienna, who is now on a visit to Liverpool, has introduced a new and fascinating keyed instrument, called the *Physharmonica*, the delicious tones of which are produced by the friction of steel bars, or some other substance. The mechanism and the principle yet remain a secret with Mr. Schultz. The crescendo on this instrument is produced by the pressure of the finger, so that it admits of every modification of expression; and what is most surprising is, that it admits of more rapid execution than the piano. It is difficult to ascertain to what class of instruments the tone of the Physharmonica belongs. A French critic assimilates it to the fine sounds of the hautboy, when played in a superior and very delicate style. The tone, however, which necessarily varies in character, in the treble, tenor, and bass, resembles the softest notes, not only of the hautboy and clarionet, but especially of the *vox humana* stop of the organ. It has all the beauty of the celestina without its defects.

SELF-ACTING COTTON MULES.

From the Manchester Advertiser.

Many of our readers are probably already aware, that within a few months past, two patents have been taken out in this neighbourhood, for Self-acting Mules for Spinning Cotton; one by Mr. Roberts, of this town; and the other by Mr. De Iongh, of Warrington; both of which, by a singular coincidence, were granted on the same day.

We understand that the one invented by Mr. De Iongh is now at work, and we have been told that it spins well, but have not yet had an opportunity of seeing it. We have, however, had several opportunities, during the last week, of observing that invented by Mr. Roberts, and we have to announce its complete success—a success, indeed, so decisive, as to astonish even those who were best acquainted with the extraordinary talents of the inventor, and who consequently formed the highest expectations as to the result of his labours. Though the machine is, to a certain extent, rude and temporary in its construction, and has been set to work under several disadvantages, it is now spinning as well as, if not better, than an hand-spinner could possibly do.

The mule to which Mr. Roberts's invention is attached, is one of 120 spindles, and quite new, having never been worked upon before, and consequently not so well adapted for the purpose as one that has been a short time in use. It has been set to work in a room of very unequal temperature (being heated merely by pans of charcoal), and with rovings in very indifferent condition; but yet, as soon as the different movements were

properly adjusted, it spun nineteen stretches (of 40's twist) without breaking a single end, and it now generally spins for half an hour together, without breaking an end in running in the carriage, which is the best criterion for judging of the merits of the invention; the breaking, in coming out, being referable to causes entirely unconnected with Mr. Roberts's patent. Indeed, it is perfectly obvious, from an examination of that part of the machine by which the difficult process of winding-on is effected, that it must possess very great and decided advantages over the hand-spinner. By a contrivance, equally simple and efficacious, the tension of the yarn in winding-on is always precisely the same, whether it is wound upon a bare spindle or a full cop; so that the cop must be throughout of an equal degree of hardness; and the tension may, with the greatest ease, be varied to any point which is requisite for spinning the finest or the coarsest yarn, or for producing the hardest or the softest cop. On this account the invention is extremely well calculated for spinning fine numbers, in which the moderate and equal tension of the yarn in winding-on is of the utmost consequence; and we should not be at all surprised, if it is made to produce yarn of a degree of fineness which has never yet been, and never can be, spun by hand.

In another point, too, Mr. Roberts's invention possesses a decided advantage over the mule in common use, and an advantage which would scarcely be expected from it, viz. a considerable saving in time. In other investments of this nature, for which patents have been obtained, the reverse has been the case—there has been a great loss of time in putting up the carriage; and this is one of the objections which have prevented their getting into general use. In Mr. Roberts's mule the various motions follow each other with as much rapidity, and may be made to proceed with as much velocity, as the yarn is capable of bearing; so that there is no loss of time in any part of the operation. So far as we can judge, all the parts of the machine are capable of ready adjustment, and not liable to get out of repair, which in a machine that must be entrusted to the management of persons of moderate mechanical skill, is a matter of no small consequence.

It may probably be supposed, that a machine so effective must, of necessity, be complicated and expensive in its construction, but this is by no means the case: it is, comparatively, a very simple machine. It is, perhaps, necessary here to explain, that Mr. Roberts's improvements are confined (with very trifling exceptions) to that part of the mule which is usually called the *head-stock*. In the rollers, the spindles, and the body of the mule generally, there is no alteration whatever; and we should suppose, that one of Mr. Roberts's head-stocks would cost little more than one of those in common use; so that where parties are getting new machinery, the difference of cost per 100 spindles would be a mere trifle. But the invention is also already applicable to old mules on the common construction, in which case it will only be necessary to remove the old head-stocks, and replace them by new ones on Mr. Roberts's plan, which may be done in about the same time that would be necessary to change one of the old head-stocks for another.

Mr. Roberts's invention possesses various other advantages of minor importance, which, however, are still worth mentioning. The alteration in the head-stock necessary for changing the count of the yarn, is effected in a very simple and expeditious manner: the head-stock itself does not extend beyond the rollers, so that when placed in the centre of the mule, it does not obstruct the view or the passage along the wheel-house—there will also be a considerable saving in shafting a mill intended for these mules, as no cross-shafts will be necessary for driving them.

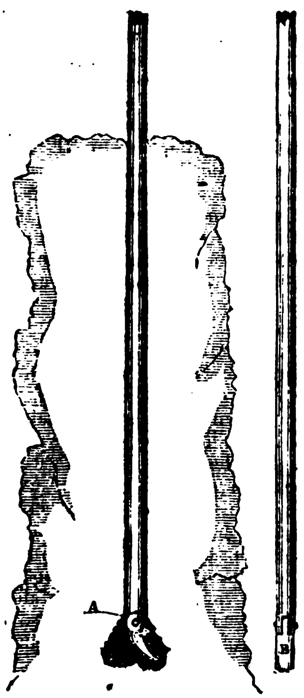
We intended to describe the construction of this important machine, which, we have very little doubt, is destined to work a complete revolution in the mode of spinning cotton;

but we find that some engravings are necessary to make our description intelligible. We are, therefore, under the necessity of postponing our description for a week or two, that we may have time to get them executed.

BLASTING ROCKS.

SIR,—In reply to Mr. Walkinshaw (vol. IV., p. 360), relative to Blasting of Rocks, the following is the sketch of a Tool which I have projected, to work a chamber at the botton of the hole, after it has been bored with the common tool as low as A.

B, from the upper side of the joint, to be three inches long, and tipped with steel.

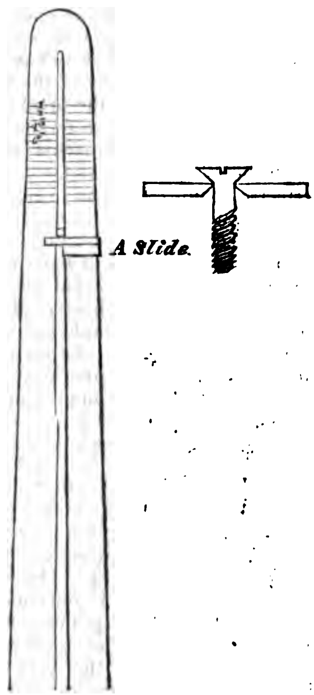


If I mistake not, you will not have the expense of charging the hole a second time, as I believe is often the case, and the blast will be greater.

I am, Sir, yours, &c.

W. SPENCER.

WOOD SCREW GUAGE.



SIR,—The want of a stand and guage for measuring the diameter of Wood Screws is universally felt; and if any of your numerous Correspondents would take the subject in hand, I have no doubt he would receive the hearty thanks of the purchasers of that article.

Wood screws are usually measured by passing the wire or rod through a hole before they are cut, and numbered from 1 upwards to about 20. By this means the purchaser cannot measure with exactness, because the thread raised in cutting will not allow it to pass. Another evil arises, from different makers using different numbers for the same sizes.

Could not a guage be made (upon a plan similar to the two-feet carpenter's rule) of steel, with various divisions, and an index, similar to the above sketch. The advantages

to be derived from it would be very great, besides the certainty of receiving the exact size ordered of the maker.

By calling the attention of your friends to this subject, you will greatly oblige one of your first and constant readers.

D. E. F.

Guildford.

POWER-LOOM WEAVING.

A Correspondent of the *Perthshire Courier* asserts, that cotton cloth made in the usual way is at least 20 per cent. better to the wearer than that wove by Power-looms. To prove this, he gives a comparative analysis of the process used in both modes. He concludes thus :—

"In the process of hand-weaving, where the wool is embodied in the cloth, the thread swells and improves the quality, and will not be so thread-bare, after some months wear and tear, as the other when finished. As a proof of this, let a woman take a piece of power-made cloth, and tramp it for fifteen minutes in one tub, and tramp a piece of hand-wove in another for the same time; then put the water of each piece, after being wrung out, through a hair-sieve, and it will immediately appear how great the difference is. The water from the power-cloth will leave a thick coat of the very best of the wool on the sieve, whilst that from the hand-wove will leave little or none. In the process of finishing, the power-made cloth will lose from a seventh to a tenth part of its substance; whilst the hand-wove will only lose from a fiftieth to a sixtieth part."

If this person's statement be found to be correct, it may go far to explain the cause of that dislike to British goods which has been lately shown in several of the Continental markets.

APPARATUS FOR TAKING PATTERNS OF MOULDING, TURNING, ETC.

Sir,—I beg leave to offer you an improvement on the highly useful apparatus of W. J. C. for taking Patterns of Mouldings, Turning, &c. as described at page 57 (No. 116) of your valuable Magazine. Let the two brass pieces or standards, A, B, instead of holes drilled in them, have a groove cut out from top to bottom, in which place thin plates of metal or wood (even card will be very advantageous for small patterns), provided that a plate of metal always forms the upper and under surface. Let a hole be drilled at one end of each of the standards, and fitted with a thumb-screw.

For Use.—First loosen the screws, apply the end of the plates to the moulding, and when correct to the pattern, tighten the screws, and the slips will be retained in their places till required.

With many thanks to W. J. C. for his valuable suggestion,

I remain, Sir,

Yours respectfully,

W. B. Junior.

November 14th, 1825.

HAZEL NUTS FOUND IN A SINGULAR STATE AT A GREAT DEPTH.

A quantity of Hazel Nuts were lately found in a bog upon the estate of Sir J. Hay, Bart. of Hayston, near Peebles, about eight feet below the surface. On opening them it was found that the kernel in all of them had entirely disappeared, though the membrane which inclosed it, and the nut itself, were as entire as if the nut had been fresh and ripe. By opening the nut carefully, the membrane could be taken out in the form of a perfect bag, without the least opening. The substance of the kernel must therefore have escaped through the membrane and the shell in a gaseous form, or must have passed through them when decomposed or dissolved by water. In some of the nuts that had not arrived at maturity the bag was very small, and was surrounded, as in the fresh nut, with the soft fungous substance which had resisted decay.

"THE ONE-WHEEL CLOCK."

SIR,—There are three articles in your interesting work on the subject of a One-Wheel Clock, viz. introduced by B. P. C. in vol. III., p. 319, complained of by your Royston Correspondent in vol. IV., p. 341, and a further explanation attempted by B. P. C. in p. 439 of the same vol.; now, will you be kind enough to grant me a corner for the latter purpose, and I will be as brief as possible?

I saw such a clock about ten years ago, but not the inside of the barrel where the operating motive exists; and about five years ago (being then at Smyrna), I made one, from the ideas I received when I saw it, by conjecture. I now find, by the latter explanation, that I was right, except in the number of divisions in the barrel, and the openings near the arbor; the former is of no consequence, so they exceed four, and the latter, *only* in removing a *trifling* obstacle to its uniform going. I shall explain these in their order. First, then, B. P. C.'s statement, that "the barrel would unwind and run down, were it not checked by the hook on the end of the line," is incorrect; as even, in such case, it would unwind as gradually as with it on, only a little quicker. B. P. C. errs also in stating, that the water flowing through the openings of the cells near the arbor, is "the grand secret of its being enabled to keep time;" for it actually consists in the time occupied by its flowing through the small shot-holes in the divisions near the outer rim, which he imagines to be air-holes! Let it be imagined that such a barrel is suspended, as in the figure given by B. P. C., and it will be seen, that were it not for its containing water, or other matter, it must run down precipitately; but being nearly half full of water, and divided into compartments, it cannot, by the weight of the material, whirl it (the water) round; yet it will still exercise a pressure of the partitions against the water, by its own weight and inclination to unwind itself, consequently the water must pass through the pin or shot holes; and by having always two partitions acting at the same time, its slow and equal motion is obtained. The pressure against the water is decreased by increasing the quantity of shot in the bottle, and *vice versa*, consequently forming a regulator of its motions; and this is its only office, except keeping the line tight enough to carry the wheel and index round.

The openings near the arbor are to suffer the small portions of water lifted up by the partition (after passing through the bulk of it) to fall again into the place of action, otherwise it would be carried uselessly half round the barrel, and the effect be a variable motion; a small portion must be so lifted, unless the partitions be made rather concave instead of flat.

If B. P. C. should think me wrong in ascribing to the pin-holes what he does to the openings near the arbor, let him explain how the lowest partition gets through the water—for this must take place—or rather the water through the partition. As truth is our mutual object, I trust that no exception can be taken at my endeavours to attain it.

I am, Sir,

Your obedient servant,

J. G——E.

Swansea.

P.S. The barrel, of course, may be made of any dimensions; the size of the shot-holes and wheel on the index arbor must have the needful attention, to obtain the quantum of motion to the index, and the trifling variation corrected by the bottle of shot. The liquid is pure water. I think five compartments sufficient; more would be needless, less would render it subject to the operation of *one* partition *only*, at certain periods of the revolution; having five, two partitions would always be acting at the same time.

INQUIRY.

NO. 168.—COLOURING TILES.

SIR,—A Subscriber to your excellent work would be much obliged by your inquiring of your Correspondents, what is the cheapest and best way of giving a permanent blue tinge or colour to red pantiles, for covering houses with, so as to make them resemble Cornish tile?

I remain, Sir,

Your most obedient sevant,

Z—.

ANSWER TO INQUIRY.

NO. 155.—FLAT ROOFS.

SIR,—The 28th Part of your very excellent Magazine having just come to hand, I observe an Inquiry by one of your Correspondents for a cheap and permanent Flat Roof. I have, for some time since, had it in contemplation of sending you my ideas upon that subject, for the purpose of obtaining the opinion of some of your numerous Correspondents who are better acquainted with those matters than I conceive myself to be. I had some reason to expect, a short time ago, to be obliged to erect some buildings in such a situation where I must have had a flat roof, and I, of course, turned my thoughts as to what would be the most economical and permanent plan that I possibly could adopt. The following, which appeared to me to be the most likely to answer the purpose, I now submit to you, requesting its insertion in your valuable pages, hoping that some more experienced person will either point out its impracticability, or confirm me in the opinion which I at present entertain of its utility:—

After laying the joist on the wall to form the roof, giving a small fall to carry off the water, I proposed to cover the whole with 3-8ths or ½-inch deal boards nailed to the joists. I then intended to put on a layer of reeds transversely upon the boards, fastening them down with rows of single laths at about nine inches or one foot apart; upon this is to be put a coat of Parker's cement, mixed up with a proper proportion of sharp siliceous sand, and floated down to a coarse, and not trowelled to a smooth surface. If this is done in fine weather, I should suppose that in a few days the whole would be perfectly dry, and when assured of that fact, pay it over with a coat of hot gas tar, which will so penetrate the cement as to form a durable and lasting covering, impenetrable to water, and may, at a very trifling expense, have a fresh coat of tar laid on whenever it may be thought necessary.

I am, Sir,

Yours respectfully,

W—— C——R.

M—ld—n.

CORRESPONDENCE.

We beg respectfully to remind the office-bearers of such Mechanics' Institutions as have not yet complied with the request made at the suggestion of George Harvey, Esq. F.R.S., in our 110th Number, for a Return of the State of each Institution at Michaelmas last, of the propriety of furnishing the same as speedily as possible, that we may be enabled to give a summary of the whole early in the new year. The object to be served is one to which every friend of knowledge should be glad to contribute.

F. O. M. expresses himself obliged to our Correspondent Q. for "the lenient manner in which he has noticed his misstatement about the cylindrical case in the Battersea Mill." F. O. M. assures us that "he has not been in the mill since he was a schoolboy, eleven years old; however, he wishes to know more, and should be much obliged if Q. would inform him in what manner the blinds are adjusted?"

*** *Notices to other Correspondents in our next.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills, Jowett,* and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

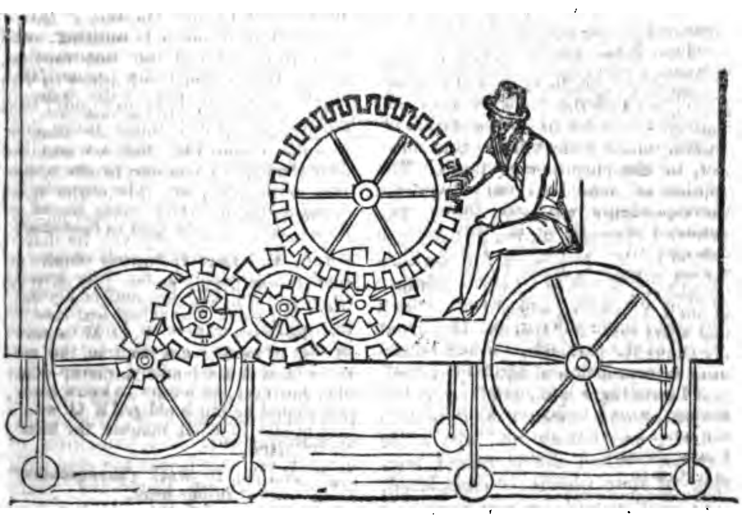
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 119.] SATURDAY, DECEMBER 3, 1825. [Price 3*d*.

"Though the motion of the cart-wheel is so obvious, and seems so plain a thing that the carman himself never looks upon it with wonder, yet, after Aristotle had taken notice of the difficulty that occurred about it, this trivial phenomenon has perplexed divers great wits, not only schoolmen but mathematicians, and continues yet so to do."—*Boyle.*

IDEA OF A MANU-MOTIVE CARRIAGE.



SIR,—Happening to take up the 97th Number of the Mechanics' Magazine, my attention was particularly called to an article headed, "Idea of a Self-acting Carriage." An ingenious Correspondent has there expressed his conviction, that the action of the atmospheric air is sufficiently powerful to raise a piston, and turn the wheel of his carriage. Now, I entirely differ from this gentleman. Atmospheric air is totally unable to work a piston, without the assistance of an artificial vacuum. It is neither so elastic nor so incompressible as steam; for, by means of a condensing pump, it may be reduced to less than half its volume. But in your Correspondent's plan there is no vacuum; the air is not in the least rarefied, but, *by its compression alone*, is to turn a wheel, in direct opposition to a most enormous friction. J—— M——'s con-

trivance is also very clumsy; the air-box, in his drawing, seems about five times the length of the vehicle; and the rims of the wheels are, I should think, a foot deep. There is another objection. If this carriage were placed on a road six or seven inches deep with mud, the valves of the bellows would get stuffed up, and the knobs, having nothing hard to oppose them, would not be at all depressed; and thus, even supposing the air sufficiently powerful to drive it along a hard surface, the carriage would stick in the mud—*for want of breath*. How ludicrous then it would be to see J— M— obliged to leave his *self-acting* carriage, and wade ancle-deep in the mud, with his *air-box* behind his back.

I shall now explain the prefixed drawing, which is an idea, not certainly of a self-acting carriage, but of one which will be propelled by manual power within the vehicle.

The rider turns round a large wheel of 30 teeth, by a screw with a handle, a tooth each turn of the handle; this turns a pinion of six teeth, on the same axis with a wheel, 10, of that number of teeth. The pinion and wheel will turn five times for one turn of the large wheel. The wheel 10 turns a pinion of five, and wheel of 10, ten turns for one turn of 30. The wheel 10 turns another pinion of five, and wheel which turns a pinion of six, on the front wheel of the carriage, about 60 times for one revolution of the large wheel.

The carriage itself is of a peculiar construction; there are only two wheels, one before and the other behind. When the increased friction of four wheels is considered, no objection will be made on this score. On each side are four iron rods, with small wheels at the end; these will prevent all danger of the carriage upsetting.

Thus I have shewn how a man may, by the assistance of a screw, easily propel a carriage. The screw will enable him to raise 288 cwts.; so that leaving out of the question the power gained by the combination of wheels, a man may overcome a weight and friction equal to 288 cwt. As to J— M—'s contrivance, I must again repeat that it will not do; and I think that no power is fully adequate to propel a carriage, without the assistance of animals, but the steam-engine, and the newly-invented vacuum engine.

I remain, Sir,

Yours respectfully,

W— B—.

PERPETUAL MOTION.

Sir,—The exploded reveries of Des Cartes, Berkeley, &c. which Mr. Pasley, and some others, seem to wish to revive, are obviously in diametrical opposition to the common sense of mankind. Thus they tell us, that *heat* and *light* are but *motions* and *sensations*—that *attraction* and *repulsion* have no existence—that there is no *vacuum* in nature, nor *projectile* force—that motion is nothing, and that mind is nothing but motion. When men suffer their ideas to run riot in this way, it is no wonder that confusion soon beomes more confounded; and that those who (like Mr. Pasley) can at one time say *motion is nothing*, should in the next moment believe that a *perpetual-motion-making cause* may yet be discovered, and that following such an *ignis fatuus* may lead to the path of wisdom. On the contrary, Sir, this vain pursuit has been known, even in the present age, to lead to poverty and ruin; and, indeed, what else can be expected, when speculators construct machines without understanding the first principles of mechanics. Such was the case with myself (perhaps thirty-five years since), when, believing that *nature abhorred a vacuum*, I constructed a syphon with a *small bore*, as far as the water was to ascend, and a *large bore* in the shorter descending leg; fully expecting that the weight of the larger column of water would *draw up* the smaller column out of a bason, and permit the liquid to fall into the vessel from whence it came, and *turn a wheel* in its descent. Another of my raw youthful speculations consisted in a water-wheel, contrived

so as to pump up water near the centre of it, a part only of which I supposed would be amply sufficient to keep the wheel in motion, by the great power it would possess if conveyed into buckets at the wheel's circumference. I did not then know the universal law of mechanics, which must inevitably demolish all similar projects in machinery, viz. *that whatever is gained in power is lost in time.*

I believe the idea, that a perpetual-motion-making cause may yet be discovered, arises principally from ignorance of the laws of Nature which relate to machinery, but partly from a notion which has been broached by certain pantheistical philosophers, that a propensity to motion is an innate and essential property of the particles of matter. Yet, in opposition to this doctrine, the natural immobility and inertness of matter are obvious wherever we turn our eyes; and the projectile motion in the planets, &c. can no more be an innate quality than it is in a cannon-ball. The whole universe is, indeed, an example of perpetual motion, as respects the larger masses of matter, yet the motion in all cases seems to proceed from an external or a mental cause.

The circulation of the blood in animals seems to be caused by a series of galvanic shocks; but a constant external supply of food, air, and heat, is indispensable, and shows that the motion of the heart, &c. is not an innate propensity. A water-mill in a large river may be deemed a real perpetual motion; but the weight or gravity of the water, which constantly carries it towards the ocean, proves that some other agent must convey it up again towards its source. This agent is obviously no other than the sun, that stupendous burning globe, without whose aid, we have the most palpable proof, that all the inherent mobility of matter would not long hinder the earth and its inhabitants, and the surrounding air, from becoming an impenetrable solid mass.

The late Dr. Herschel, I believe, invented the notable dogma, that the sun, though the cause of heat, at ninety-five million miles distance from us, may not perhaps be very hot itself. He may, therefore, be justly deemed the father, or rather the regenerator, of the new (or common-sense) philosophers, of which Sir R. Phillips is the president.

Mr. Pasley's new version of this doctrine is, that "*there is no hot body in nature.*" The inference is correct enough, if the premises were good; but no one can wonder that such theorists should pursue the same track, till they have annihilated *attraction, repulsion,* and *projectile force,* which Sir Isaac Newton (that unfledged chicken in philosophy) would have deemed the main pillars of the universe. What! is the projectile force (as exemplified on the largest scale in the planetary system) a nullity? On the contrary, that is precisely the kind of force which all perpetual-motion-seekers should cherish above all others; for it is acknowledged that bodies projected into space move on *ad infinitum* with their original velocity, unless *obstructed* by the air, or some other agent. What a pity that perpetual-motion-seekers are so deficient in corporeal powers; for if any of them could contrive to project a body with such velocity as to pass once round the earth (in defiance of attraction), this new satellite would prove the possibility of perpetual motion against all gainsayers. But even then they would not have gained an atom of mechanical power! A fly-wheel of a steam-engine may, in the same way, be put into perpetual motion, provided the surrounding air could be taken away, and the friction of the axles be rendered infinitely small. Sir R. Phillips says, "matter, in varied momenta, constitutes all the power with which we are acquainted." I beg to ask the common-sense philosophers (as a test of their system), whether the projectile force of a fly-wheel can be imagined, in the smallest degree, to depend on the contact or motion of any particles of matter impinging against each other; or whether they suppose a power resides in the particles composing the wheel to *conti-*

nue a motion which, it is self-evident, they did not *originate* in any single instance?

If they will not attempt to give an intelligible application of their principles, I think, Mr. Editor, they should not be permitted to confuse the ideas of your mechanical readers by vague assertions, calculated only to make them believe that nothing is definitively known and settled in philosophy, and that Sir Isaac Newton, so long acknowledged as the prince of philosophers, was nothing but a blundering blockhead. Without wishing any one to place a blind reliance on great authorities, I think no person ought to presume to promulgate any anti-Newtonian doctrines, till they have given sound reasons for rejecting the established system.

Let any one add to or alter Sir Isaac's philosophy as reason and experiment may dictate; but for speculators to attempt to build a new system out of their own imagination, without having first refuted the Newtonian system, would be to risk the adoption of the puerile and baseless theories which distinguished the infancy of human knowledge.

Thus I have heard a gentleman (in other respects very intelligent) express his belief of an absolute *plenum* in Nature; though it is evident round particles can touch others in but few points. He also ascribed the motion of a cannon-ball to the rushing in of the air behind it in its passage. Mr. Pasley, in the same way, talks of external or internal pressure on bodies, without the smallest hint of the possibility of either taking place in the absence of attraction and repulsion; and Sir R. P. talks of the *fitting* surfaces of bodies—I suppose a kind of *dove-tail work*, as a substitute for attraction. If I am asked how I suppose motion can take place, unless on mechanical principles, I reply, that I consider it to be demonstrable that matter does move, and that it cannot move itself, and therefore its motion must originate in a superior power, and it is continued in a regular systematic mode, indicating thought and contrivance, and implying an intelligent, powerful, and supreme agent.

It appears that man is permitted to learn by degrees the laws of nature, but he must remain entirely ignorant of the essence or intrinsic qualties of the first particles of matter. What do we know, for instance, of the *hardness* or impenetrability of matter, but that, in certain points of space, a *repulsive power* is exerted, which we cannot overcome? And we know nothing of the mode of operation in any of the laws of nature, except that they are regular exertions of a power which does not reside in the inert, unconscious atoms which we call particles of matter.

I fear the delusive projects for perpetual motion have been encouraged in no small degree by the disingenuousness of the Marquis of Worcester, who, like some of your Correspondents, scruples not to insinuate that he has actually succeeded in this hopeful attempt.

The wheel that he speaks of in No. 56 of his "Century of" ingenious speculations, rather than "inventions," certainly would *not move of itself;* though it is possible to make the weights descend at a greater distance from the centre than their ascending distance.

No. 78 of the "Century" is a watch to go *constantly*, and which seems to have contained some animating principle, since, like most other *operatives*, it will go the better for being often looked at.

No. 98, the Marquis's "*semi-omnipotent engine*," which was to be buried with him, is, without doubt, Mr. Pasley's desideratum, the true *motion-making cause*, and ought to be disinterred without delay.

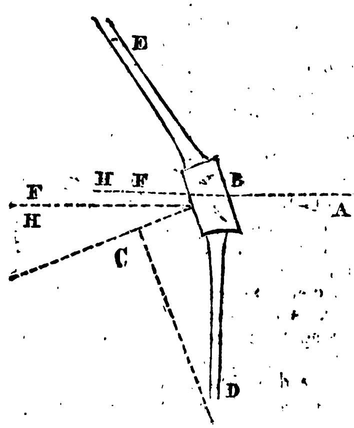
Nos. 99 and 100 are complete castles in the air, or else they are worth a thousand of modern perpetual motions. The descent of one pound is to raise 100lbs. as high as the one pound falls, in defiance of the mechanical principle, that what we gain in power we must lose in time, &c. With the valiant Marquis, *gravity* is a mere toy, a bauble,

which perhaps he disbelieved, or cared as little about, as Sir R. Phillips, Mr. Pasley, or Sam. Yelsap; which latter gentleman's name, like a witch's prayer, or the new philosophy, may as well be read backwards as forwards. The *semi-omnipotent engine*, by the help of a few children, rather than men, might supply all London with water, and even turn the Thames out of his course, at a short warning.

If this deified machine cannot be recovered from the Marquis's grave, neither he nor the undertaker ought ever to be forgiven, for depriving the world of so inestimable a treasure, which was evidently worth more than all the steam-engines in the world; for it is evident, though the inventor seems not aware of it, that if a child's power can thus be increased a hundred or a thousand fold, a little of this accumulated power can easily be spared to set it in motion, and the child may sleep quietly in its cradle.

I am, Sir,
Your obedient servant,
T. B.

CONICAL WHEELS.



Sir,—Perhaps some of your readers will inform me if the following objections to Conical Wheels are just.

The prefixed figure is meant to represent the wheels of a carriage seen from behind.

CAB is the axletree, of which the part BC is inclined to the horizon, in order that the spokes, BD, of the conical wheel, may come perpendicularly to the ground.

Now, if we draw DC perpendicular to BC, it is evident, I think, that F, cos. CBH, is the effectual force which causes the wheel to revolve, supposing F to represent the friction of the roads. Hence it is plain that much force is wasted. Also, the weight of the carriage being sustained by the axletrees, it is plain that the reaction of these being perpendicular to them, a great part of the weight must be supported by the collar of the nave. Also, the wheel being conical, it would not, if left to itself, proceed in a straight line, but would describe a circle, like the top of a wine glass on a table; and it requires considerable force to counteract this tendency, to say nothing of the tearing of the roads.

I am, Sir, yours, &c.
F. O. M.

SHOOTING STARS ARE SATELLITULÆ, OR LITTLE MOONS.

Sir,—In reply to your Correspondent W. W.'s concluding query (Number 13, p. 79), I beg to state, that an abundant series of observations has satisfied me, that an inconcievable number of solid bodies (small in comparison of any of the known planets or their satellites, yet of very considerable bulk and weight, some of them) are in continual revolution round our earth, in elliptical orbits, having almost every degree of obliquity to its axis, and of longitudinal and latitudinal places of perigeo, at any assigned epoch: the perigeic portions of these orbits, which lie so near to the earth, as to intersect or dip into its atmosphere, but a small distance, it is, which occasions the phenomena of Shooting Stars: the resistance and friction, which even very attenuated air opposes to the almost inconceivable velocities of these bodies, occasions a heating and a superficial combustion of the masses during their continuance in oxygenous air, and the light evolved thereby reaches our eyes, as a short streak of light, very frequently to be seen, almost whenever the air is quite clear, and the moon, and larger planets and stars, are distant from the spot we select to watch attentively.

When the satellitulæ dip deeper into our oxygenous atmosphere than is mentioned above, their apparent courses are longer, and more brilliantly obtrusive on our observation; and when these satellitic bodies dip very deeply into the atmosphere, we no longer call their appearance shooting stars, but *meteors*. These latter, owing to the violent combustion of their surfaces, and nearer proximity, are heard and seen to exfoliate (rather than burst), and the luminous and rough fragments that are scattered, follow the body for a short time, and are denominated *meteoric sparks;* which latter, owing to their very greatly increased resistance against the lower and denser air, fall obliquely to the earth, and are denominated *meteorolites,* or stones fallen from the clouds, but with which last these meteors have nothing to do; they very often traverse a clear sky, and vanish instantly therein on passing out of our atmosphere.

I remain, Sir,
Your obedient servant,
J. Farey.

POWER OF THE RUDDER IN RIVER NAVIGATION.

Sir,—Balloons having been spoken of in a conversation at which I was lately present, the impossibilty of directing their course was naturally accounted for from their floating in the air, without the means of applying any other force; and the analogy of a vessel floating down the stream of a river was adduced as an illustration; the expedient adopted on the rivers in South America, of dragging an anchor, as noticed by Captain Hall, was mentioned.

One gentleman, however, stated, that he had observed heavy barges on the Thames near Windsor, when coming down the stream, directed by the rudder alone, without the use of either sail or oar.

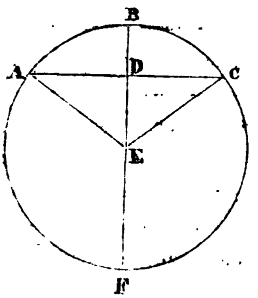
Presuming the fact to be correctly stated, it will be obliging if any of your Correspondents will explain, in an early Number of the Mechanics' Magazine, the principal upon which this is effected. The only explanation which I am able to give, is, that either the streams being short, the barge does not, while under its influence, attain the same degree of velocity; or that means are found to place part of the barge in a direction, so that part shall be acted upon by water having one degree of velocity, while the rudder is in water of a different degree of velocity.

I am, Sir,
Your most obedient servant,
A. B.

THE QUESTION OF SPECIFIC GRAVITY.

We have already given a solution, by Mr. Bevan, of this question, and

now select from several other answers the following, from an esteemed Correspondent: not on account of any difference in its results (which are precisely similar to those of Mr. Bevan), but as presenting another instructive specimen of elegant and exact analysis.



Let AFC represent a vertical section of the cylinder, ADC the segment immersed, and draw the lines as per figure.

Since ABC is 3-11ths of the circumference, ∴ AFC will be 8-11ths; and supposing the radius AE=1, the area of the circle will be 3.1416 ∴ the area of the sector, AECD, will be $3.1416 \times \frac{8}{11} = 2.2848$. Also, $360^\circ \times \frac{3}{11} = 98^\circ\ 10'\ 54''$, measure of the angle ACE, $\therefore \frac{1}{2}$ (AE·EC) × natural sine $98^\circ\ 10'\ 54'' = \cdot 4949$, area of the triangle AEC. ∴ 2.2848 + .4949 = 2.7797, area of the immersed segment AEC ∴ By hydrostatics, the area of the circle AFCB is to the area of the segment ADC, as the specific gravity of the fluid is to that of the body. Now, the specific gravity of water being 1000 ∴ 3.1416 : 2.7797 :: 1000 : 885, very nearly. Hence the specific gravity of the body is 885 ounces avoirdupois.

I am, Sir,

Yours respectfully,

G. S.

London.

Question.

P.S. Suppose the diameter of a solid cylinder of wood is 20 inches, what will be the external and internal diameters of a hollow cylinder of the same kind of wood, and of the same length, so that the quantity of wood may be the same in both, but the lateral strength of the hollow cylinder double that of the solid. G. S.

PRIZE CHRONOMETERS.

At the suggestion of several esteemed Correspondents, we this week lay before our readers a Table, which we have compiled from the Monthly Official Reports, of the state of the competition for the first six months, between the different Chronometers which were entered at the Royal Observatory, Greenwich, for the prizes to be awarded this year to the two best. There are but two prizes, so each competitor is allowed to enter two Chronometers only. In our next we shall give a Table of Results, and some further necessary explanations.

PRIZE CHRONOMETERS ON TRIAL AT THE ROYAL OBSERVATORY, GREENWICH, FROM THE 1st of MAY, 1825, TO THE 30th of APRIL, 1826.

	Baird, No. 2875.			*Baird*, No. 2959.			*Baker*, No. 782.			*Barwise*, No. 185.			*Barwise*, No. 9294.			*Brockbanks*, No. 900.			
	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	Extremes of Thermometer.
	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	° °
May......	+4.74	4.1		+2.29	2.1		−1.71	8.7		+2.93	2.8		−1.54	2.2		+2.39	2.8		54..66
June.....	+3.12	4.5	7.54	+2.97	1.4	3.11	−1.28	3.4	6.91	+4.32	2.2	5.48	−1.17	2.1	2.89	+3.37	3.1	4.91	54..75
July......	+1.26	6.4	11.96	+2.99	2.2	3.30	−0.14	3.2	7.24	+4.89	2.5	6.42	−0.39	1.9	4.37	+3.92	2.9	5.99	63..82
August...	+1.63	3.5	11.47	+3.65	1.8	4.59	−0.51	2.9	7.69	+4.82	2.7	6.47	+0.79	1.7	6.63	+4.46	1.9	6.81	63..76
September	+1.67	4.2	11.50	+3.97	4.1	5.68	−0.80	4.3	7.64	+3.46	4.2	6.80	+0.42	3.6	6.96	+2.34	7.3	7.84	60..74
October ..		Withdr. Sept. 30			Withdr. Oct. 2.		−2.80	6.2	10.10	+1.35	5.3	10.36	−0.73	1.4	6.81	−1.13 Withdr. Oct. 30.	2.7	14.51	45..64

	Brockbanks, No. 901.			*M^c Cabe*, No. 167.			*M^c Cabe*, No. 168.			*Cathro*, No. 1685.			*Cathro*, No. 1703.			*Cotterell*, No. 637.			
	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	Ext. of Ther.
	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	° °
May......	+3.03	6.3		+2.17	1.6		+1.18	2.2		+1.70	3.3		+3.14	1.4		+1.05	2.2		54..66
June.....		Withdr. May 31.		+1.22	3.1	4.25	+0.83	1.6	2.60	+1.74	2.2	2.83	+3.63	1.4	2.38	+1.18	2.3	2.51	54..75
July......				−0.45	3.1	7.84	+0.32	3.2	4.05	+2.48	2.0	4.06	+4.06	1.8	3.37	+1.48	3.0	3.36	63..82
August...				−0.48	1.8	7.70	+1.10	2.9	4.19	+2.55	3.7	4.50	+4.69	2.4	4.85	+1.55	2.6	3.52	63..76
September				−0.51	2.0	7.68	+2.49	2.8	6.88	+2.76	3.9	5.14	+5.19	3.0	6.10	+1.60	2.9	3.70	60..74
October ..				−0.16	2.6	7.73	+3.59	2.4	9.06	+2.65	3.9	5.29	+4.83	2.8	6.23	+0.81	3.3	4.30	45..64

PRIZE CHRONOMETERS ON TRIAL AT THE ROYAL OBSERVATORY, GREENWICH, FROM THE 1st of MAY, 1825, TO THE 30th of APRIL, 1826.

	Cotterell, No. 647.			*Cummins*, 19—23.			*Cummins*, 19—34.			*Dallas*, No. 133.			*Desgranges*, No. 20.			*Desgranges*, No. 35.			
	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	Ext. of Ther.
	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	0 0
May......	+ 1.38	2.2		+ 4.05	3.9		+ 3.06	2.4		+ 3.34	1.8		+ 0.94	2.6		— 0.30	1.6		54..66
June.....	+ 1.84	1.6	2.82				+ 4.65	3.4	6.08	+ 3.26	3.3	2.71	+ 1.56	3.7	4.39	— 0.26	1.5	1.63	54..75
July......	+ 2.34	1.2	3.58		Withdr. May 31.		+ 6.74	3.4	10.43				+ 2.86	4.3	7.37	— 0.55	1.1	1.98	63..82
August...	+ 3.75	2.7	6.66				+ 7.63	2.9	12,16		Withdr. July 5.		+ 1.60	3.5	7.36	— 0.48	0.9	1.85	63..76
September	+ 4.16	2.6	7.62										+ 1.82	4.1	7.48	— 0.93	2.1	2.78	60..74
October ..	+ 3.77	1.9	7.59					Withdr. Aug. 31.					+ 3.10	2.4	7.75	— 1.61	1.6	4.17	45..64

	Ellicott, No. 946.			*Ellicott*, No. 947.			*Finer & Nowland*, 304.			*Finer & Nowland*, 367.			*Frodsham*, 192.			*French*, No. $\frac{20}{3912}$.			
	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	Ext. of Ther.
	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	0 0
May......	+ 0.60	2.4		— 1.37	3.8		+ 0.56	1.4		+ 1.49	2.9		— 6.29	11.3		+ 4.75	1.3		54..66
June.....	+ 0.91	2.8	3.22	— 1.53	4.0	4.22	+ 0.26	2.5	2.55	+ 1.61	2.2	2.79				+ 4.30	1.7	2.40	54..75
July......	+ 0.80	3.0	3.35	— 1.06	3.5	4.71	— 0.56	3.6	4.74	— 2.26	7.4	11.91		Withdr. May 31.		+ 4.14	1.6	2.75	63..82
August...	+ 1.81	1.7	4.89	+ 0.12	3.0	6.63	— 0.26	2.4	4.71	— 0.66	2.3	11.44				+ 4.43	1.4	2.72	63..76
September	+ 0.13	4.7	6.28	— 0.15	2.8	6.52	— 0.13	3.6	4.94	— 1.43	2.9	11.28				+ 4.50	0.9	2.60	60..74
October ..	— 3.64	8.2	14.70	+ 0.95	3.5	8.23	— 0.09	3.0	4.99							+ 4.65	1.2	2.57	45..64
	Withdr. Oct. 31.									Withdr. Oct. 2.									

PRIZE CHRONOMETERS ON TRIAL AT THE ROYAL OBSERVATORY, GREENWICH, FROM THE 1st of MAY, 1825, TO THE 30th of APRIL, 1826.

	French, No. 975.			*Goff*, No. 774.			*Goff*, No. 775.			*Hall*, No. 399.			*Harris*, No. 678.			*Jackson*, No. 512.			
	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	Ext. of Ther.
	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	° °
May......	+ 2.71	1.4		− 2.31	4.4		+ 1.83	5.7		− 4.05	2.2		+ 13.87	1.5		0.72	3.9		54..66
June.....	+ 2.54	1.5	1.79	− 3.72	5.1	7.57		Withdr. June 18.		− 2.98	2.3	4.39	+ 14.25	1.4	2.21	0.26	2.2	2.97	54..75
July......	+ 1.93	2.8	3.46	− 6.86	6.1	12.30				− 1.43	2.5	7.57	+ 14.37	1.6	2.50	0.05	2.0	4.04	63..82
August...	+ 2.30	0.9	3.21							+ 0.02	2.2	10.44	+ 14.84	2.3	3.64	0.62	3.1	4.14	63..76
September	+ 2.36	1.1	3.10		Withdr. Aug. 13.						Withdr. Aug. 30.		+ 14.91	2.6	3.96	0.35	2.9	4.16	60..74
October ..	+ 2.79	1.4	3.24										+ 14.85	1.9	3.96	1.30	2.8	5.32	45..64

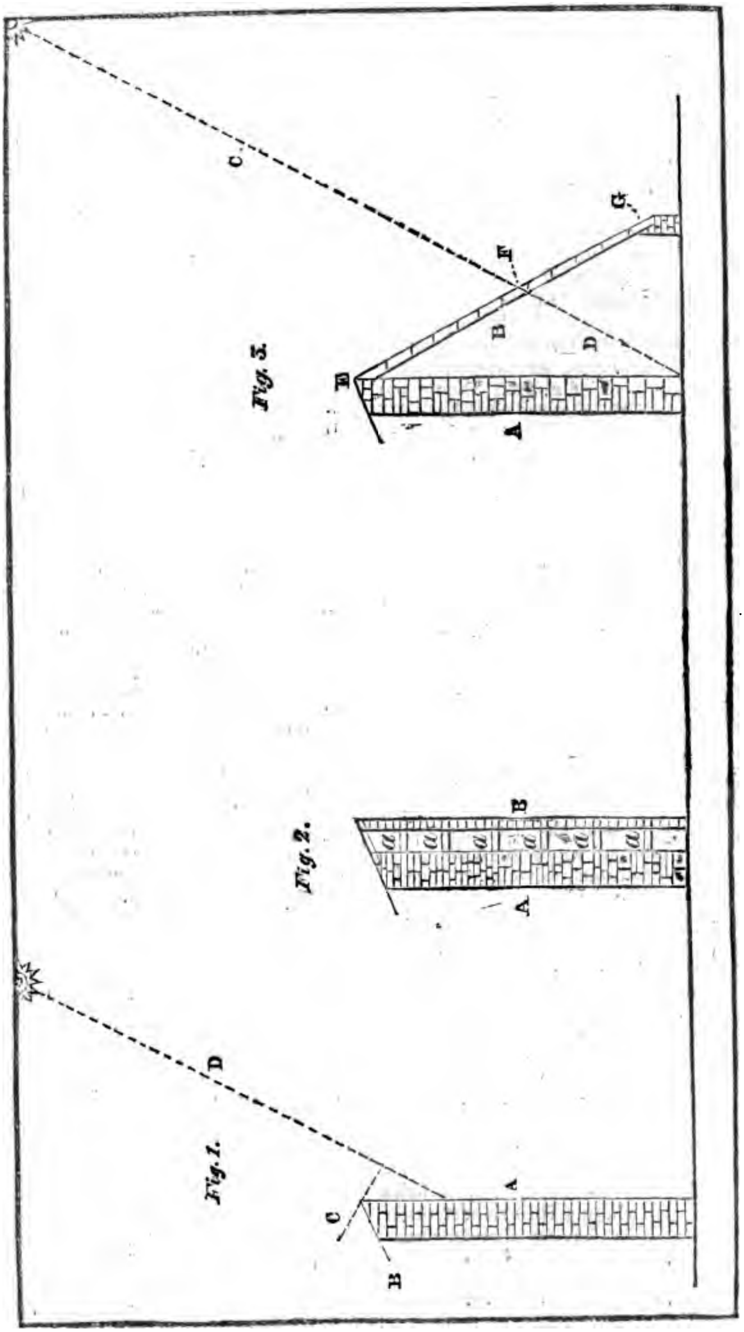
	Jackson, No. 675.			*Lowden*, No. 1.			*Lowden*, No. 2.			*Molyneux*, 850.			*Molyneux*, No. 862.			*Norton*, No. 536.			
	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	Ext. of Ther.
	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	° °
May......	+ 2.71	2.0			Found stopped May 13.		+ 0.00	3.0		+ 3.74	2.3		+ 1.03	4.5		+ 2.16	1.9		54..66
June.....	+ 3.35	1.6	3.08				+ 1.30	1.7	4.95	+ 3.97	2.1	2.66	+ 0.58	1.8	4.05	+ 2.07	4.4	3.33	54..75
July......	+ 3.75	1.4	3.75				+ 2.74	2.4	7.85	+ 4.70	5.3	5.15	+ 0.97	1.5	3.50	+ 2.09	3.7	3.51	63..82
August...	+ 3.89	1.2	3.91				+ 3.87	1.9	9.99	+ 6.39	3.1	8.50	+ 1.41	1.1	3.88	+ 3.76	2.8	6.58	63..76
September	+ 2.90	2.5	4.10				+ 4.07	2.2	10.38	+ 7.10	2.3	9.74	+ 1.49	1.3	3.86	+ 4.68	2.0	8.18	60..74
October ..	+ 2.37	2.8	4.28				+ 3.18	2.4	10.41	+ 7.94	2.1	11.27	+ 2.04	1.6	4.89	+ 6.04	3.2	10.94	45..64
																	Withdr. Oct. 31.		

PRIZE CHRONOMETERS ON TRIAL AT THE ROYAL OBSERVATORY, GREENWICH, FROM THE 1st of MAY, 1825, TO THE 30th of APRIL, 1826.

	Porthouse, No. 6281.			*Rigby*, No. $\frac{1}{100}$.			*Roskell*, No. $\frac{117}{28180}$.			*Scott*, (A.)			*Scott*, No. 130.			*Smith*, No. $\frac{1}{25}$.			
	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	Ext. of Ther.
	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	° °
May......	+ 1.79	3.1		+ 3.01	3.4		+ 2.11	2 7		+ 0.99	10.9		— 0.42	5.8		+ 4.27	2.3		54..66
June......	+ 2.44	1.9	3.80	+ 4.92	3 6	7.32	+ 1.64	2.1	3.34							+ 4.89	2.3	3.54	54..75
July......	+ 3.65	2.3	6.15	+ 7.22	3.0	11.09	+ 2.08	2.0	3.21		Withdr. May 31.			Withdr. June 29.		+ 6.14	2.7	6.17	63..82
August...	+ 4.18	2.4	7.20	+ 8.67	1.8	14.27		Found stopped Aug. 11.								+ 7.31	2.9	8.63	63..76
September	+ 3.89	2.3	7.18		Withdr. Aug. 31.											+ 8.64	4.1	11.60	60..74
October ..	+ 2.68	5.3	7.66														Withdr. Sept. 20.		45..64

	Tayler, No. 560.			*Tayler*, No. 602.			*Webster*, No. 638.			*Webster*, No. 710.			*Widenham*, No. 944.			*Widenham*, No. 945.			
	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	M. daily rate.	Ex. variation.	Prize comp.	Ext. of Ther.
	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	° °
May......	+ 2.91	2.8		— 0.33	2.3		— 0.08	2.2		— 0.81	3.8		+ 1.27	1.9		— 0.98	1.6		54..66
June......	+ 3.37	1.6	3.02	— 0.15	1.9	2.46	+ 0.27	2.0	2.80	— 0.28	2.2	4.06				— 0.51	1.6	2.54	54..75
July......	+ 3.84	1.4	3.79	+ 0.03	1.9	2.75	+ 0.35	1.2	2.66	+ 0.42	2.7	4.36		Withdr. May 31.		+ 0.03	2.3	3.85	63..82
August...	+ 3.62	2.4	3.91	— 0.15	2.0	2.74	+ 0.60	1.5	3.08	+ 0.25	2.3	5.21				+ 0.59	1.8	4.94	63..76
September	+ 2.90	2.9	4.10	+ 0.01	1.5	2.64	+ 0.63	1.7	3.14	+ 0.54	2.3	5.36				— 0.49	3.4	5.28	60..74
October ..	+ 1.34	3.5	7.43	— 1.09	3 7	4.46	— 0.16	2.9	3.50	— 0.71	3.3	5.47				— 2.50	2.7	8.41	45..64

GARDEN WALLS.



ON GARDEN WALLS.

We have selected the following answer to the inquiries of "A constant Reader," in Number 113, from eight different communications with which we have been favoured on the subject, as being, on the whole, the best entitled to the premium offered by the inquirer. It may be satisfactory to state, that it agrees in most points with the other answers (two excepted), and excels them chiefly in practical circumstantiality and clearness. One or two of the more important of the additional observations furnished by our other Correspondents, we have subjoined in the form of notes. Should our friend, "The Retired Shopkeeper," wish to see all that has been offered to us on the subject, we shall forward the different papers to him for inspection, on being favoured with his address.

Sir,—Having had some little practical knowledge of Gardening, "in the South-west of England," and having likewise given particular attention to the theory of heat, on which I have made frequent experiments, I presume to offer the information requested by "A constant Reader."

That brick walls are superior to all others for the growth and perfection of fruit, is a fact of which every gardener, who has had experience with different kinds of walls in similar situations, is well convinced.

In theory it is thus accounted for :—Different substances have different capabilities of conducting heat. Metals are the best conductors; and arranged according to their conducting powers, the following substances will stand thus: diamond, topaz, glass, marble, siliceous and hard stony bodies in general, porous and earthy kinds of stone, bricks, wood, down, feathers, wool, and other porous articles of clothing. Hence it is easy to conclude from what cause arises the superiority of brick walls in bringing fruit to perfection. Stone walls, having a greater conducting power, pass off the heat almost as quickly as absorbed; while the brick walls, by a longer retention, give out the heat during the absence of the sun's rays; and when the days are long and fine, and the nights short, the brick walls do not give out so much heat during the night as they absorb during the day, and thus they go on accumulating, till longer nights or damp weather again reduce them to a level with the surrounding atmosphere. It is evident, that this superior power of retaining heat must be beneficial to the growth of fruit, especially such fruits as are very susceptible of injury from cold, and universal experience puts the matter beyond a doubt. (A)

(A) W. T., while he agrees that brick are much superior to stone walls, offers some reasons for believing that slate are superior to both. "Near," he says, "to where I am writing, there is a wall with a southern aspect. Part of it is built with brick, and part of it with stone. Very fine and very strong shoots of a flourishing vine are trained over both the brick and the stone parts of the wall, and likewise over a slate roof which joins on to the wall. I have had an opportunity of witnessing the produce of this vine for several years, and though I have observed, that from the stone part of the wall (which is as well situated and more covered with the vine than the brick part) there is now and then gathered *fine fruit*, yet, *in quantity*, it has always been exceeded by the fruit produced on the smaller portion of the brick part of the wall. Again, the part of the vine trained over the slate roof has always been much more prolific than either of the other parts; so that from this it appears, that though brick is to be preferred to stone for training fruit trees to, yet slate is to be preferred to both."

We may say of this conclusion, however, that it is at least not warranted by the premises from which it is drawn. Before we can assume that the slate roof was the cause of the superior produce, we ought to know what it covered—a warm kitchen, or an ice-house. May not, also, the longer perpendicularity of the sun's rays in such a situation have had its influence?—Edit.]

So much for the superiority of brick walls. But it must be remembered that there are various kinds of stone, and that some of them approach very near to brick, in their power of retaining heat. Any stone that will *polish* will certainly make a very bad wall for the growth of fruit; but some stones so nearly approach to the nature of brick, that where bricks are dear, and the stone cheap, the stone may be used to advantage.

A *brick facing* to a hard stone wall would certainly prove beneficial; but the bricks, if it be possible, and not too expensive, should be separated from the stone by some still weaker conductor of heat—some dry, porous kind of earth would serve the purpose. I think that a kind of double wall of brick and stone, only connected together here and there with cross pieces of wood, may be constructed at very little more expense than the mere stone wall with brick facing; and this would be the best of walls for the retention of heat, and the wood would likewise serve as a firm support on which to nail the larger branches. In this case the two walls would be separated by the best of non-conductors of heat—by a *confined air*. It is from this property of confined air, that double doors are found so serviceable to furnaces to prevent the escape of heat, and that double walls are almost indispensable to ice-houses, to prevent the influx of heat from without. (B)

As a warm wall is the principal object to be obtained, let it be built upon what plan, or with whatever kind of materials it may, it ought to be blackened. A black surface absorbs all the sun's rays which fall upon it; any other colour absorbs but a part. The superiority of a black surface may be thus proved:—Take two flat tiles, and colour one with lamp-black, and the other with whiting; place them with the coloured sides to the sun, at a small distance apart, and then place a *differential thermometer* so that its two bulbs shall touch the two tiles on the shaded side; the fluid in the tube will soon indicate a higher temperature in the blackened tile. Let any one try this experiment, and conviction will be certain. To prove the goodness of different walls, thermometers may be hung out during the day, and examined late at night, and again in the morning. (C)

A projection of the coping is in several respects injurious, and I do not think that it is in any way beneficial. It shades a considerable portion of the wall; it is a harbour for snails, which are very injurious to fruit; and it deprives the tree and fruit near the top of the wall of those refreshing showers which are so much needed by wall-fruit. Of course, the wall should be kept as dry as possible, but it should not be done at the expense of the above-mentioned injuries. The wall should be made as smooth as the nature of the materials will allow, and the mortar should be firm, and not liable to moulder. If these particulars be attended to, the wall will not absorb much wet, as the rain will run off almost as fast as it falls. The coping

---

(B) S., of Bath, justly sets great store on a suggestion to the same effect, but says he has "had no opportunity of seeing it practised." A. B. C. supplies what both R. H. and S. will be glad to be informed of—an instance where the principle has been carried into full effect. "Your Correspondent," he says, "may see a garden-wall built on this plan to the extent of several hundred feet, and to the height of eight feet from the ground, at Northam Bridge, one mile from Southampton, on the Portsmouth road. I have no doubt that it is as strong as if built solid."

(C) W. T. gives another and more commonly practicable method of determining this point. "Take," he says, "a shilling, blacken it, and expose it with another not blackened to an equal degree of heat before the fire. When both of them are well heated, try which you can best bear on your finger, and you will then, from your own feeling, soon receive the best proof possible, that dark objects absorb more heat than light ones."

may have a slight projection on the outside. (See fig. 1.)

Concerning the width of foundation required for a wall of a given height, I can say but little. Garden walls should not be less than ten feet high; and it appears to me, that all walls of this height should be built with buttresses. Supported in this way, the thickness of walls may be considerably reduced. Buttresses are generally built on the outside of the wall; but when this is inconvenient, and the regular appearance of the inside is not a material object, they may be placed in the inside. They do not injure the wall for the growth of fruit, but, on the contrary, the fruit on the buttress will always ripen the best, owing to the superior position (see fig. 3.) of the face of the buttress, in regard to the sun's rays.

The *arching* of the wall may be useful (but I have never seen it adopted) for east, west, and south walls, in order to give the roots more room to spread; but it would not be advisable to adopt it for the north wall, as, in this case, the roots would spread into a soil which rarely had the benefit of the sun's rays. By north or south wall, I mean north or south by position: gardeners generally term that wall the north wall which faces the north, and the same of the others. A wall facing the north is but of little value. Currants, and some few sorts of plums, may be cultivated on it, to pay for the labour bestowed; but the superior kinds of wall fruit will not pay for nails and shreds. The wall facing the north will receive most benefit by being arched. The arches must not be so high as the top of the soil, as a current of air near the trees would be highly injurious.

The annexed figures, representing cross sections of walls, may serve to illustrate the preceding views.

In fig. 1, A is a plain brick wall, with a crossing, B, such as I conceive would be useful. The dotted line, C, represents a coping over the face of the wall, in order to show its effect in shading from the sun's rays, represented by the line D, the altitude being 62°, agreeing with the altitude of the sun at Midsummer.

Fig. 2 is a section of a double wall. A, the back stone wall; B, the front wall of brick (say half-brick thick), joined to the back wall, and supported by the pieces *aa*, &c. One great advantage of a double wall, besides those before enumerated, is, that by means of a stove at one end, the wall may be heated throughout, at any time when a cold atmosphere threatened the destruction of the fruit. The crop is oftentimes nearly destroyed by a cold night or two late in the spring.

Fig. 3 represents a wall, under what I conceive the most favourable circumstances for rearing fruit to perfection. A, the back wall; B, the front wall or scaling, supported on wood, and inclined so that the sun's rays may fall on it more perpendicularly, and hence in greater numbers. I have no notion that this plan will suit "A constant Reader," but I think that it deserves the attention of those who are desirous of growing fine fruit, and to whom a little extra expense, and the loss of the extra ground occupied, are not objects of much importance. Suppose the sun to be elevated for June the 21st, and CD a ray falling on the bottom of the wall, A; here it is evident that the quantity of rays falling on a perpendicular wall, equal in height to the wall A, is only equal to the quantity falling on the distance, EF, of the inclined wall, B. But EG is in length no more than the height of A; and, therefore, all the rays which fall on the distance, FG, are gained by the position of the wall; that is, the heat obtained by an inclined wall will be to the heat obtained by a perpendicular wall of the same surface, as EG is to EF. Gardeners always adopt an inclined position for their forcing-beds; and I am confident that it would be highly conducive towards the rearing of fruit to perfection. A solid brick, in shape resembling those used in malt-kilns, would be advisable; these may be fitted into grooves in the wood supports, leaving a portion of the wood level with the

bricks, on which to nail the branches. I am certain that a south wall may be built on this plan to great advantage. It should be made air-tight, if possible, and it may then be heated with a stove at one end, if such were found necessary.

I trust that the above will be found correct and useful. My views on the subject are the result of much observation, combined, as I have said before, with experience in gardening, and a pretty general knowledge of the theory of heat. Being a favourite subject, I have, perhaps, written to a greater length than your pages will allow; the desire to give as good information as I possibly could, must be my excuse. If there be any points on which your Correspondent may desire further information, I will readily supply it, as far as I have the means.

I am, Sir,
Respectfully yours,
R. H.

MR. SCOTT'S NEW SILK MACHINERY.

Amongst the simplest, yet most effective improvements which we have witnessed in machinery, is a Patent Winding Engine, which is now at work at the factory of Messrs. Pattison, in Congleton. Its advantages over the old engine are numerous, and amongst others the following may be mentioned. By the old engine, the end or thread of silk is unwound from the hank by means of a revolving motion given to the bobbin to which the silk is attached, and on which it is wound; but to effect this, it is evident that the motion must, for all silks, be very narrow, and even then, so fine a fibre being made the agent by which motion is given to the swift on which the hank is placed, it must be constantly liable to break on any unevenness of the thread or motion of the swift: there are some silks imported into this country so fine, that, for the above reasons, they could not be wound on the old engines. In the new engine, we observed that this motion was given by means of a driving wheel to both the bobbin and swift; and, by a proper calculation of the speed of the driving power, the bobbin takes up just so much silk as is given off by the swift. A very ingenious method is made use of to regulate any variation caused by the increase of the bobbin on becoming full, and the consequent decrease of the hank. This is effected by means of a lever (on which the bobbin rests), over which the silk passes to the bobbin. This lever being affected by the slightest pressure or tension of the silk, the bobbin is retarded until the swift has given up a sufficient quantity to supply it, thus taking all strain from the silk, and (acting as a regulator) allowing the engines to run from two or three times the speed of the old one, with less waste. The engine is the invention of Mr. Scott, of Leek, and is the first of the kind which he has sold.—*Leeds Independent.*

NOTICES TO CORRESPONDENTS.

F. O. M. Yes; any back Numbers which he may require.

We shall be glad to have a continuation of F. G.'s favours.

The papers of Mr. Hammersley—R. H. B.—J. R. M.—A Dyer—G. M. N——n—are in the hands of the Engraver.

Communications received from—Mr. Bell—W.—H. S.—C. Rogers—Z.—E. V. N. P. P.—Dephos—1825—L. R.

*** *Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills, Jowett,* and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 120.] SATURDAY, DECEMBER 10, 1825. [Price 3*d*.

"What stubbing, ploughing, digging, and harrowing, is to land—thinking, reflecting, examining is to the mind."—*Berkeley*.

"Doth any country flourish in wealth, in grandeur, in prosperity? it must be imputed to Industry—to the Industry of its Governors in setting good order—to the Industry of its People, following profitable occupations."—*Dr. Barrow*.

COMPOUND CRANE.

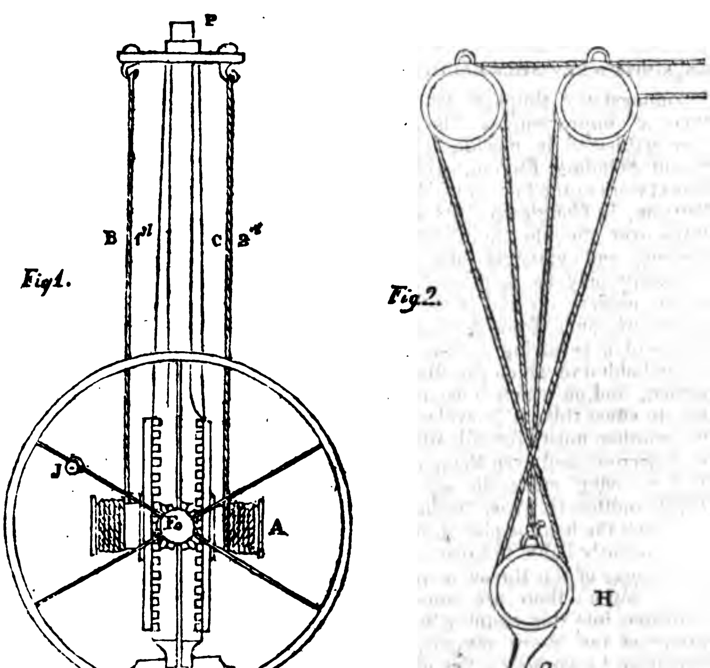


Fig. 1. *Fig. 2.*

COMPOUND CRANE.

Sir,—As I have found many instructive things in your Magazine, I am happy to devote a few moments to its prosperity, by submitting to you and the public a brief description of what I conceive to be a great improvement in the common Crane.

It consists entirely in a compound or more systematic arrangement of the mechanical power of the pulley now in use. According to all calculations, the first rope round the pulley next the burden furnishes the data for determining the power or strength of the crane; so that if it bears 500 cwt., and there are four ropes, the power of the crane is one ton. But the power, as it appears to me, might be applied and calculated otherwise. For instance, let each rope be applied to two sheaves; the power of each will be 1000 cwt.; and the machine will do the same work in half the time. The prefixed engraving will suffice to explain my meaning. The principal figure exhibits a common crane; only that there are two falls, B 1st, and C 2nd, coming in at once, and passing through the lower sheave or block, as shown in the second figure, as many times as you want power.* These falls, B and C, coil, one on the top, and one on the under side of the winches, having no communication with one another but by the nut. As the connexion of the three will teach you, that one goes one way and the other the other, by driving the fly-wheel, A, at the handle, I, whereby O and P, the pivots, are placed at top and bottom, to suit the side direction, in loading or discharging they may be encircled by a rack underneath the fly, which may be taken away without interruption, when not required in use.

M. W.

SAFE MODE OF BURIAL.

Sir,—On perusing the three volumes of the Mechanics' Magazine which have been published, a Magazine which certainly "joins both profit and delight in one," I noticed many plans and schemes for the prevention of dead bodies being taken from graves. Now, as a plan occurred to me, which, I fancy, would effectually prevent the depredations of resurrection-men, and as the plan is novel, simple, efficacious, and economical, I thought I could not do better than transmit it to the Mechanics' Magazine.

After the coffin is lowered into the grave, and just sufficient earth been thrown in to cover the coffin, I would then put on a layer of reed or straw, a few inches thick; then a layer of earth, and so on alternately, until the grave be completely filled. The corpse being thus covered, would, I consider, be secure; for the time and difficulty attending the digging of such a grave would render the attempt fruitless, until the straw is rotten, and by that time the corpse would be useless.

I am, Sir, yours, &c.

Nella.

Holloway, Exon.

PERPETUAL MOTION DISCOVERED;

Or, a Plan by which a Vessel may be made to continue in powerful Motion, without any Assistance, as long as her Materials endure.

Sir,—If the following lines do not warrant the title prefixed to this letter, some of your Correspondents will, I hope, be kind enough to point out the error into which I have fallen.

The principle on which I depend is the well-known law in hydrostatics, that the pressure of water is the same at the same depth, whatever may be the diameter of the vessel which contains it.

Let a boat be constructed, having a bottom as flat as possible; let two parallel boards (each of equal dimensions with the bottom of the boat) be strongly connected together, having an interval between them of about an inch. By a contrivance similar to that which unites the upper with the lower board of a common bellows, affix these boards, thus

* See on this point the description of White's Patent Pulley, Mechanics' Mag. vol. I. page 24.

connected, to the bottom of the boat, in such a manner that they may be readily susceptible of an alternate ascending and descending motion, in a space of about two or three feet in height, to which water must have no access. In the centre of these boards, or of this moveable frame, fix a strong iron rod, extending upwards through the boat, and attached to the machinery for working the paddles. In the upper part of the moveable frame make a small aperture, to which firmly secure a narrow tube, extending upwards through a hole in the bottom of the boat. At the bottom of this tube let there be a sliding valve, which, by a very simple contrivance, can be closed the very moment that the frame reaches its greatest distance from the bottom of the boat, and as speedily re-opened when the frame comes in contact with the boat. Through this narrow tube continue to pour water into the moveable frame, until both it and the tube are full. The space between the frame and the bottom of the boat must be always free from water. The vessel now is ready for action. Let us suppose that, owing to the upward pressure of the sea, the frame is now in contact with the bottom of the vessel; to remove it to its greatest distance from the vessel, nothing more is required (according to the above principle in hydrostatics) than an altitude of water within the narrow tube, a little greater than the level of the sea (or if the tube be not sufficiently long, a weight pressing on the water within the tube equal to the weight of a column of water of the required altitude, will be equally efficient, and far more convenient). If the valve be opened, this altitude of water will be applied, and the frame will then be forced to its greatest distance from the bottom of the vessel, and will then consequently have closed the valve. The valve being closed, the pressure of the water in the tube is no longer continued on the sheet of water within the moveable frame, so that the sea will then, with a power nearly equal to the weight of the vessel, force the frame upwards, with the iron rod affixed to it, and thereby set the machinery and paddles in vigorous motion, and impel the vessel either against the tide, or in any other direction which may be required. When the frame comes again into contact with the bottom of the vessel, the valve is again opened—the water in the tube again presses on that within the frame—the frame again descends; and thus it will continue *ad infinitum*, without any assistance whatever.

Hence, if a vessel of this description were placed in a circular channel of water, it would continue to revolve, without any assistance, as long as the materials which composed it would endure.

I am, Sir,

Your very humble servant,

ALPHA.

Cornwall.

[We leave some of our many intelligent Correspondents to exercise their acuteness in the examination of Alpha's scheme. It appears to us to rest on a fallacy quite easy of detection.]—EDIT.

MINERAL DESCRIPTIONS.

(To be continued occasionally.)

ANTIMONY.—This metal received its name from the circumstance of Basil Valentine, a German Monk, having given several of his monastic companions a dose of it, thinking it would be conducive to their health, he having before given it to hogs, which it purged and then fattened; but, unfortunately, the poor brothers of the cowl all sickened and died; hence it was called *Antimoine—Anti-Monk*. Antimony is discovered in mines of all the metals, but that from gold mines is esteemed the best; it has also mines of its own in France, Norway, Hungary, and elsewhere. Its ores are numerous, but the grey is met with in by far the largest quantities, and which is a sulphuret of this metal. It is also sometimes combined with ochre and with nickel. In Sweden it has been found native, with a small alloy of iron and

silver; and in the State of Connecticut, in America, it occurs nearly in its pure metallic form, frequently being seen on the surface of the earth in large masses. This is a brilliant, brittle metal, full of little shining threads, easily cut or scraped, and tarnishes by exposure to the atmosphere. It is of specific gravity 6.712. It is with some difficulty fusible by fire, but dissolves more readily in water, and has no ductile power and but little tenacity. Antimony may be easily known by its swelling, and evaporating in white smoke, when the flame from a blowpipe is directed upon it, leaving a dark-coloured residuum. Nitric acid acts upon it slowly, but upon bismuth very readily, which will show the difference of the two metals. Antimony is applied to a great variety of uses in the arts. In medicine it is more abundantly employed than any other metal, though its introduction was effected with great difficulty. *Currus Triumphalis Antimonii*, a work published by Basil Valentine in the fifteenth century, was the first book which brought it into vogue as an internal medicine: it afterwards lost its repute until Paracelsus, an eminent chemist and physician, some years after, again raised its reputation. It was received and rejected several times before it acquired an establised place among medicaments; and at the present day its virtues are much extolled, and its various preparations much employed by, medical practitioners. It is also used in colouring glass, in forming specula for telescopes, and it forms a part of the composition called bell-metal, the sound of which it improves. With lead it is used for casting printer's types, rendering them firmer and more smooth; and in the casting of cannon-balls it is employed. Refiners also use this metal in some parts of their process. In ancient days ladies of high rank and fashion were accustomed to stain their eye-lashes and brows with it, thereby setting off the lustre of a fine eye to greater advantage.

Bismuth is a metal of so peculiar an appearance that it cannot well be mistaken if once seen, though it is not easily to be described. It is of a yellowish or reddish-white colour, and, when broken, shows flat surfaces of a variegated hue, according as it is displayed to the light. A blow from a hammer will readily break it, and it is easily reducible to powder, being of an extremely brittle nature. It has neither taste nor smell. At 460 deg. of Fahrenheit it melts, and when fused, its specific gravity is 9.8227. If the heat is urged very high, it ignites, and burns with a small blue flame. The criterion by which this metal is detected from all others, is by water causing a precipitation of the *white oxide* when added to its solution in nitric acid. Another method of discovering it is by adding a colourless solution of galls to the acid solution before mentioned, and a *brown* precipitate will immediately ensue. Bismuth is found native in many places, occurring often in veins of gneiss and mica slate. An arseniate of this metal has been found at Helsenburgh in Sweden, and in Germany. The sulphuret of Bismuth, called *Bismuth glaneo*, has been found in Cornwall, Saxony, and elsewhere, though rarely. It is sometimes met with combined with copper, and also with nickel, lead, and some other of the metals. Bismuth is chiefly employed in conjunction with other metals, rarely being used alone. In the manufacture of printer's types it is sometimes employed, and the well-known article *pewter* is composed of this metal, with an admixture of tin and brass, and sometimes lead. In the making of solder it is in request; and when added to most metallic substances, renders them more easily fusible. It is used occasionally in medicine as a tonic. Perfumers employ it as a cosmetic for the skin, under the name of *pearl white*, which is an oxide of this metal, though by its application very unpleasant and sometimes dangerous consequences have ensued.

DRYING AND PRESERVING FLOWERS AND PLANTS.

Sir,—If you think the following method of Drying and Preserving Flowers and Plants deserving of a place in your very useful Magazine, it is heartily at your service.

As I possess a complete *hortus siccus*, preserved in the way I am about to describe, I shall offer no other apology for troubling you with this answer to your Correspondent, Philo-Botanicus. Provide yourself with a few sheets of blotting paper, the number to be regulated by the juiciness of the plants; having stretched one-half the paper on a table, arrange the parts of the flower or plant

to be dried in the manner you think it would afterwards look the best; lay the other half of the paper over the flower or plant as harmlessly as possible; then, with a smoothing-iron well heated, you may easily extract all the moisture. Keep moving the paper as often as it becomes wet; continue the operation until no moisture comes. The advantage of this method is, that the flowers so prepared retain the original colour. If you intend the specimen for a *mélange*, moisten one side of the flower with a strong mucilage of gum, when it will readily adhere to paper. If you wish to preserve it still farther, wash the whole repeatedly with a solution of isinglass, preparatory to its receiving a wash of copal varnish. In this way the plant may be preserved in full colour to an indefinite period. Sea-weeds preserved in the same way look exceedingly beautiful, as their variety is endless. As I carry the affair a little farther, for I draw and paint the plant on the opposite page, and affix a short description of it, I shall be happy to communicate such farther hints as may be of use to your botanical Correspondents.

I am, Sir,

Your constant reader,

C——.

5, King-street, Holborn.

USE OF DOUBLE CYLINDERS.

Sir,—Having subscribed to your invaluable Magazine from the commencement of its publication, I have often been struck with the great diversity and coincidence of ideas developed on the subject of the Steam-Engine, in the mode of its construction, application, and the estimating its power; and, if not too much exhausted of its novelty and importance, by the repeated observation of your numerous intelligent Correspondents, I would, with your permission, be added to the list.

In Number 109, p. 394 and 395, observations are made by Correspondents, "L'Ami des Machines-à-Vapeur," and "Edmund Farnley," of applying steam from the high-pressure to the low-pressure cylinders, the practicability and advantages of which (though not generally known) have been for some time in operation, and the adoption of which justly merits the encomiums of "L'Ami des Machines-à-Vapeur." But cannot the steam from a high-pressure boiler be immediately applied to the condensing cylinder, without the expense and intervention of the high-pressure cylinder? It seems to me, that in operation it will be equally easy and effectual. The only precaution necessary to be observed in carrying this project into execution, would be to pay extraordinary attention to the fitting up of the throttle-valve, so as not to allow more steam to pass into the condensing cylinder than will make the required vacuum to overcome the resistance.

I conceive this to be the most economical use of steam; for by such application the well-known principle is called into action, that "steam will increase in expansibility in a much greater ratio than the degree of heat necessary for its generation" (the consequent saving of consumption of fuel); I shall hence infer, that the "density of steam" so generated wholly applied to the "formation of a vacuum," combines all the power of which steam is available on known principles, thereby superseding the necessity of two cylinders, and equally applicable to steam-engines on the low-pressure system.

The application of "highly compressed steam" to the "formation of a vacuum," is the very object attained by the operation of the two cylinders.

I am, Sir,

Your obedient servant,

An Experimenter.

Halifax.

BLOWING HOT AND COLD.

Sir—It is a well-known fact, and, I dare say, there are but few of your readers, although they may not have

paid any attention to the cause, who are not aware that we blow hot and cold with the same breath. *Honi soit qui mal y pense.* The explanation of this singularity may not be unacceptable to them. When the breath is slowly expelled from the body, it becomes charged with the heat of the lungs, and thus we blow hot; on the contrary, when the mouth is nearly closed, and the breath expelled with force, it carries along with it, acting on the principle of the lateral motion, a current of the surrounding air, and thus we blow cold. It must, and certainly does, appear rather paradoxical to say, that, with the same breath, we blow hot and cold. I hope, however, this explanation will be found good and true; if it is not, I trust those of your friends who can, will supply the deficiency, correct the blunder, or expose the error. By so doing, he will confer a favour on the writer of this; and if he does not, he is criminal in allowing any thing like fiction to pass without his notice.

I am, Sir,
Your obedient servant,
T. M. B.

SECRETS IN SELLING.

Sir,—Since sending you an article on this subject, I have met with the following observations on the elasticity of air; and as the subject is interesting, I take the liberty of offering them to you for insertion.

"The elasticity of aëriform fluids is a force of singular energy; the effects which it produces are wonderful, and human industry, applying it to mechanical purposes, derives from it very great advantage; it is therefore of importance to know, and to measure with precision, this force in those fluids of which we can most conveniently make use—such are the air and aqueous vapours.

"The elasticity of fluids exerts itself in all directions with equal force; wherefore the pressure of an elastic fluid upon a given base is always proportional to the surface pressed. If we imagine a prismatic column of a known substance, of mercury for example, which insists perpendicularly on the given base, and pressing it with its whole weight, is in equilibrium with the force of the elastic fluid, the altitude of this column will measure the force which the fluid exerts against the base by its elasticity. Mercury is chosen in order to compare the elasticity of different fluids with that of the air in its natural state, which, as is well known, is measured by the the mean altitude of the barometer, *i. e.* by the altitude of a column of mercury of 0.76 metres.

"EXPERIMENT I.

"In order to discover according to what law the air's elasticity varies while its density increases, Mariotte (Mouvem. des Eaux, Part II. Disc. 2.) made use of a long syphon, having its two cylindrical vertical branches connected by a short horizontal tube. The branches were of unequal length, the shorter hermetically closed at the top, the longer open; through this he poured a little mercury, just enough to fill the horizontal tube, and to confine the air in the shorter branch. He then went on pouring in more and more mercury, and noting at every time the level at which it stood in both the branches; thus he was enabled easily to discern the proportion in which the density of the air included in the shorter branch went on increasing, because the density necessarily increases in the inverse ratio of the spaces into which the air was successively crowded; and the elasticity was measured by the difference of the level of the mercury in the two branches, there being added to it 0.76 metres for the weight of the atmosphere pressing on the longer branch. The result of many trials made in the above manner was, that under the same temperature the elasticity of the air is proportional to the density. This proportionality, which is found to obtain in the mean compressions of atmospheric air, cannot, with equal certainty, be ascribed also to the greatest and least compressions. In these no trials have been made; besides, the compressing weight may vary indefinitely, but the density cannot vary indefinitely." *

* Philosophers suppose the air to consist of particles endued with a repulsive force. Now, if the weight of mercury be increased sufficiently, the particles of air will be brought into contact, and the air will be incapable of being compressed any more. This explains what the author has, I think, shortened too much.

If this extract meet with your approbation, I will shortly send the remaining part, which relates to the variation caused by heat and cold.

I remain, Sir,
Respectfully yours,
Nottingham. F. O. M.

P. S.—1 metre = 3.2809 feet, English. 1 foot = 0.3048 metres.

ERRATUM.—No. 115, vol. v. p. 36; for *a* . 0004266, read *x* . 0004266.

PROVISION IN CASE OF ACCIDENTS.

SIR,—It would be intruding too much on your valuable pages to *expatiate* on the subject of such accidents as happen indiscriminately in a town numerously peopled; it is shocking enough to humane feelings to know that they do happen, and that *so frequently* that I am at a loss for the reason why they are not as well provided for as they are extensively regretted. When a broken limb or any other casualty happens, much delay and a variety of inconveniences often, *too often*, heighten the misfortune, till at last, perhaps, a large weighty door, indented with mouldings and raised framing (*quite an uneven surface*, you will observe) is procured, and the sufferer is conveyed to the nearest Hospital upon men's shoulders. Now, observe in how few of such cases, *four* or *six* men are likely to be on the spot, equal enough in stature to carry the sufferer steadily. This might be provided against at little expense and trouble, if every licensed victualler *would*, or if the Legislature would decree that *he should provide a light, strong frame, six feet six inches long, by two feet four inches wide*, with a proper bedstead sacking, or, perhaps, smooth thin boards might do for the surface, to lay the patient on. The two side pieces of the frame should extend about fifteen inches beyond each end, *as handles to a barrow*, but not long enough to spring like poles of a sedan chair; and there might be handles on each side for those who might be found ready to assist. Now, as it is known how well *two* men can carry a heavy chair, with the additional weight of their *fare*, it is evident that *two men only* could carry a man on such a simple machine as I have described. To give a drawing would be superfluous, and to engrave it an unnecessary expense. Could your extensive publication excite the completion of the above proposition, I should feel happy in having offered it to you. A halfpenny subscription from every mechanic engaged in buildings, every painter, plumber, glazier, &c., and hackney-coachmen, perhaps, and carmen, and watermen, would supply, I believe, such a machine for every public-house in London, without any "legislation" at all. Some general system should be adopted *for the better provision against the moment of accident*. Some of your ingenious readers and contributors *may, from this well-meant suggestion*, offer a more improved scheme; if not, I must hope that mine will be attended to, as I have written it from frequently witnessing the fault I would remedy hereby.

I remain, Sir,
Your obedient servant,
C. HAYTER.

Buckingham-street, Portland-road, November 24th, 1825.

EXTINCTION OF THE SUN.

SIR,—When your Magazine first made its appearance, like a new and friendly planet in our horizon, I hailed it as a desideratum both to the man of science and to the humble mechanic, and I instantly commenced subscriber, in the hope of adding something to my previously acquired little stock of knowledge. In this hope, I am happy to say, I have not been altogether disappointed; therefore, whenever I have met with any thing that I did not thoroughly comprehend, or thought absurd or useless, I have imparted my own ideas on the subject (as I considered that all were therein invited so to do), knowing that it would elicit something by way of explanation from your numerous and well-informed Correspondents; when, if wrong in my opinion (and who is always right?), I am open to conviction, and 'tis information that I want; nor let the wisest think himself entirely free from error, or incapable of further improvement.

So much for preface—now for the matter in point. I cannot altogether assent to the opinion of your Correspondent F. O. M., that such remote

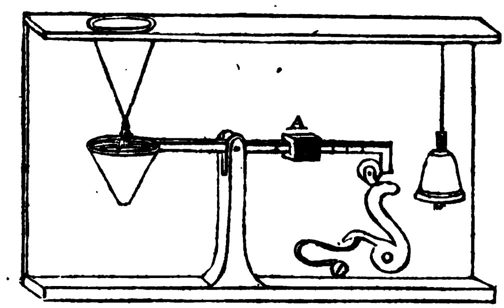
subjects as these are calculated to enlarge the mind, and make it more intimately acquainted with the principles of physical science. I still think that they are more likely to confuse the ideas, by wandering out of the course of probabilities into the endless maze of speculative theorems. The true position of the question appears to be simply this :—That if a circumstance which is impossible (or, perhaps, I had better say, that is in the highest degree improbable) was to happen, another circumstance, which is a contingent on this improbability, would happen also. I do not say but that Mr. B.'s calculations may be mathematically correct, but it certainly appears to be going extremely out of the way to calculate upon a subject, that, if it could possibly occur, no one would be left alive to ascertain whether the fact were so or not. Beside the moon being then darkened, I question whether, in such an event, it would be seen at all from the earth, except, perhaps, as it passed in transit between it and the fixed stars, which would still shine with undiminished lustre, and this, in fact, would be the only light the earth or moon would receive.

I beg to assure F. O. M. that I spoke of the sun as the centre of gravity in relation only to this system; that I am also aware of the centrifugal properties of the planets, and of the difference that the removal of the sun's centripetal force would make on the motions of the moon, &c. However, I shall be happy to hear F. O. M.'s reasons on the subject, particularly as he appears inclined to treat it with that suavity that can alone render information agreeable, or which I alone (in reference to Indicator) should think it worth my while to notice.

I am, Sir,
Your humble servant,
T— J—.

Hammersmith, Nov. 22, 1825.

IMPROVED ALARUM.



SIR,—You would much oblige me, if, through the medium of your valuable Magazine, you would communicate to the public the enclosed drawing, representing an Improved Alarum, which can be made to strike at any particular time, by moving the piece of iron, A, backwards or forwards, as occasion may require. Its construction is so very simple as to need no further comment.

I am Sir,
Your humble servant,
I. A.

November 10th, 1825.

MECHANICAL DIAL, WITHOUT WHEELS, SPRING, OR WEIGHT.

Fig 1

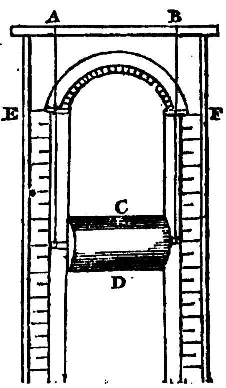
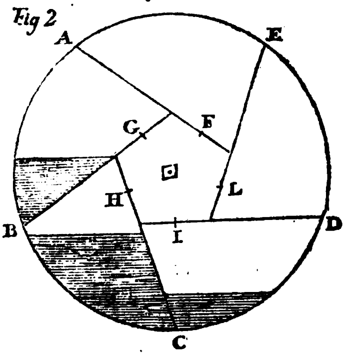


Fig 2



Sir—Having lately seen, in Number 76 of your interesting Magazine, an account of a clock with only one wheel, I send herewith an account of a Clock, which is, I should suppose, upon the same construction, extracted from that instructive and amusing work, "Hooper's Rational Recreations."

"*To construct a Mechanical Dial without Wheels, Spring, or Weight.*

"This dial consists of a tin or copper barrel or cylinder, CD, which is supported by two strings of catgut, that are fastened to the points A and B. This cylinder may be about a foot long, and nine inches diameter.

"The principal mechanism of this dial is in the internal structure of the cylinder, which is represented by fig. 2, and consists of five divisions, that are formed by the five pieces, AF, BG, CH, DI, and EL, placed perpendicular to the ends of the cylinder: all these divisions must be exactly equal; and in each of the partitions, almost close to the circumference of the cylinder, there is to be a small hole, such as is made with a large needle. In the divisions must be placed a quantity of water, equal to about one-fourth of the content of the cylinder, but the exact proportion can be determined by trial only. This water should be distilled, or at least well filtered, that it may not, by growing foul, impede the motion of the machine; and if there be a due quantity of spirits mixed with the water, it will

be thereby prevented from freezing. At one end of the cylinder is a small hole, by which it may at any time be emptied; this hole is to be stopped by wax. The barrel being brought up to the points A and B, by winding the string round its axis, it would there rest; but the water oozing through the small holes in the upper partitions, destroys its equilibrium; and as it slowly and gradually descends, the small points at the end of its axis show the hours, and parts of an hour, according to the number of divisions on the scales E or F. If this dial goes too fast or slow, it may be easily regulated, either by diminishing or increasing the size of the catgut, or the quantity of water in the cylinder."

This account, I think, may perhaps be of some use to your Correspondents who may not have the work it is extracted from in their possession, as it is so simple, so easily made, and, as I should imagine, so correct.

I am, Sir,
Your most obedient servant,
H. C—LL.

VALLANCE'S APPLICATION OF THE LEVER TO THE DOUBLE CRANK.

SIR,—Your ingenious and intelligent Correspondent, Mr. F. O. M., wishes me to give a more detailed account of the Double Crank, represented in the 106th Number of the Mechanics' Magazine. The application of the lever to the crank appeared so simple that I considered it would easily be comprehended by a sight of the figure. I have to observe that the double crank is quite common, and its advantages well known, at least to the generality of mechanics; but the application of the most powerful of the mechanical powers, the lever, to the driving of machinery, is certainly new, simple, and advantageous. I have applied it to both single and double cranks. Mr. F. O. M. seems to think that the rods which work the cranks are not both the same length. The weight on the under end of the lever makes it hang perpendicularly: of course the cross arms of the lever are horizontal. The double crank is also horizontal, but, in order to show the crank, it is represented a little obliquely. It would be foolish if we were to argue that a round wheel is oval, although it appears so when viewed in an oblique direction: see the drawing, fig. 2. The rod which appears longest is attached to the crank nearest us; we have, therefore, a better view of it than of the other rod, which is attached to the crank farthest from us, and is inclining inwards at the upper end, which makes it appear shorter.

I am, Sir,
Your most obedient servant,
DIXON VALLANCE.

MAGNETIC SERIES.

SIR,—I wish to ask your scientific Correspondent, Mr. Jennings, whether, among all the experiments on electricity, &c. it has ever been proved, that a Series of Magnetic Bars possesses no sensible electrical or galvanic influence when placed with their opposite poles alternately insulated in a row of wine glasses, containing water, pure or salted, in the manner of some of Volta's expements with zinc and copper, &c.

I am, Sir,
Your obedient servant,
T. B.

A QUESTION OF PROJECTILES.

Suppose a cannon-ball to be attached to one end of a line or chain, of 300 feet in length, and the other end of the line to be fastened to a pivot at the top of a column, standing alone, of 300 feet in height. Let the line be drawn tight, and the ball be discharged from a cannon at a distance of 300 feet (of course, at the same height from the ground) in a horizontal direction. *Query.* Would the ball (allowing for the weight of the chain or line, and also for the resistance of the air to the same, as well as for the friction of the pivot) pass through as much space before it attained a state of rest as if it had been discharged free from incumbrance, and consequently proceeded, as regards right and left, in a straight line? If not, what would be the deficiency, and the cause of the deficiency?

CENTRIPETAL.

GRAND SOLAR ECLIPSE.

Sir,—Can any of your astronomical Correspondents inform me when we may hope to see a total or an annular eclipse of the sun in England? The last total eclipse was on the 11th of May, 1724, and the last annular on the 1st of April, 1764.

I am, Sir,

Your obedient servant,

Bubo.

November 22nd, 1825.

The following paragraph, which we extract from a country journal, will, we presume, suffice for an answer to our Correspondent:—

"Wednesday, the 29th of November, 1826, there will happen a total and visible eclipse of that distinguished luminary, the sun, which will not only be palpable, but also the largest we can expect for another ten years in this country. It will begin at about a quarter of an hour before ten o'clock in the morning, and terminate at about seven minutes past one o'clock, P.M. Among the places where this eclipse will be seen, besides England, are France, Spain, Italy, Germany, Norway, Sweden, the greatest part of Russia, and also Turkey."

A COMPENSATING PENDULUM OF DEAL.

Sir,—On reading, a short time ago, the Philosophical Journal for January last, I met with an interesting paper, relative to Pendulums, by Mr. Squire, of Epping, in which he points out the effects of the atmosphere on the arcs of vibration, and also briefly mentions the different compensating pendulums that have been invented, but at the same time remarks, that the grid-iron and mercurial are those mostly used in our best astronomical clocks. He then observes—"Valuable as these pendulums doubtless are, in a philosophical point of view, yet they are found to be too expensive for general use. For this reason I would recommend the wood pendulum in preference to all others, as combining, in one important unity, cheapness and utility; and I am, moreover, convinced from experience, that a pendulum with a deal rod, previously prepared and properly managed, will perform, under similar circumstances, equally well as the best compound pendulum that has ever been invented.

"For this purpose take a straight-grained, well-seasoned piece of deal, perfectly free from knots, and which, in the rough, may be about one inch in breadth, half an inch in depth, and three feet and a half in length; let it be exposed for a considerable time to a gradually increasing heat, till at last its surface becomes a little charred; it may then be planed to its proper breadth and thickness, and after cutting it to the required length, let the surface be well coated with copal varnish, and the ends dipped in melted sealing-wax, to prevent the least moisture penetrating the wood, which is of the utmost consequence to the accuracy of the pendulum in its simple state. But still if, after all, the pendulum should be found to be in some degree affected by the changes of the atmosphere, we happily have, in the nature of wood, a remedy at hand for this inconvenience.

"As the expansion and contraction of deal is much greater across than in the direction of the grain, cut a small block from the waste piece, equal in length to the width of the pendulum rod, and of the same thickness, which may be about ·78 of an inch by ·37 respectively; let this block be placed with its grain at right angles with that of the rod, having its lower side resting on the nut at the bottom of the pendulum, and its upper side supporting the bob, and which, if judiciously placed behind the front plate, will not only be nearly out of sight, but may be so contrived as equally to compensate for the upper part of the screw, and the small piece of spring on which the pendulum is hung. Experiment proves that, with deal, the block need not be more than half an

inch in width, for the compensation of a second's pendulum rod of the same material.

"It is almost unnecessary to remark, that the compensating block should be from a part of the same rod as the pendulum to which it is applied, and also be in every other respect similar as to previous preparation," &c.

Now, Sir, I consider this compound deal pendulum a very ingenious and useful invention for an economical observatory; and if you are of the same opinion, perhaps you will give this a place in your scientific and wide-circulating publication. As this pendulum rod can be applied to the most common household clock by any mechanic of the least ingenuity, I have no doubt but that, if once adopted, it will very soon be found to supersede the absurd method of suspending the bob by a rod of brass or iron, which must always be affected by the changes of temperature, so as to cause the motion of the clock to be very unequal.

I remain, Sir,
Your constant reader and wellwisher,
J. Ball,

Birmingham, Oct. 25th, 1825.

USE OF THE BAROMETER AS A STORM INDICATOR.

We have repeatedly brought under the notice of our readers the use which might be made of the Barometer on board Ship, as an indicator of approaching tempests (see Mech. Mag. vol. II. pp. 20, 71, 210; vol. III. p. 135), and now extract from the *Hull Advertiser* some confirmatory observations on the subject.

"To our mercantile friends we strongly recommend the use of the barometer. No ship should be without this excellent instrument, which foretels bad weather by a sudden and remarkable diminution in the column of quicksilver; and when this takes place below a certain degree, which may be termed the *stormy point*, then the weather becomes *tempestuous*. This point differs according to the situation of the place from the equinoctial line. At the Isle of Mauritius, in the Indian Ocean, it is 29.8 inches, and in the vicinity of the Cape of Good Hope 29.6 inches; but what it may be in this north latitude we have not as yet had sufficient data to determine, perhaps 29 inches. Such a sudden diminution in the weight of the atmosphere having taken place, as to cause the barometer to fall thus quickly and considerably, indicates 'that an uncommon degree of rarefaction of that part of the atmosphere is in progress; and it will be inevitably followed by a violent reaction. From that moment the ship has passed the circumference of a circle, the centre of which is the centre of danger.' It is then necessary, indeed essentially necessary, for the seaman to take every precaution for the safety of his vessel, 'inasmuch as it then approaches the centre of the atmospheric expansion.' Some are bold and hardy enough to run before the wind, and have been the cause of the wreck of their vessel, which generally, in such cases, is materially damaged; but those that lie to, escape with comparatively little or no damage. Many instances could be mentioned to elucidate this; one, however, may be perhaps sufficient. From the 24th to the 26th of October, last year, the ship Louach, W. W. West, commander (an excellent navigator), being in lat. about 30 S. and long. 45 E., encountered a storm. The approach of the bad weather was indicated by the fall of the barometer to 29.6 inches, entering at that time 'the circle of danger.' All sail was taken in, except what was necessary to steady the ship, in order to combat with the high sea. This storm was from the N.W., accompanied at times by vivid lightning and heavy squalls of rain, proceeding from a bank of clouds in the direction of the wind. Birds of the pelecanus genus, so frequently met with in these latitudes, swam on the high waves, being unable to continue their flight, owing to the great force of the wind; and the ship was tossed about considerably by the heavy sea, so that the rolling was very great. The vessel,

however, by the precaution taken by the Captain—that of lying to—although buffeted by the elements, was not injured. The barometer fell on this occasion to 29.2 inches."

MR. CRANE'S ALLEGED INVENTION FOR SAVING THE LIVES OF SHIPWRECKED SEAMEN.

SIR,—I cannot allow the communication of your Correspondent S. R. C. to pass unnoticed. The plan he suggests as the invention of Mr. Crane, and the drawing he has given, may be seen in a work entitled "The Hydro-Aëronaut, or Navigator's Life Buoy," by Cleghorn, published in 1810 by Richardson, Cornhill. How S. R. C. came by the plan and drawing he has sent to you, of course I know nothing about; but whether originating in mistake or otherwise, as you give every man in your work the Englishman's only request—"*a clear stage and fair play*"—S. R. C. can avail himself of it if he chooses.

I am, Sir,

Yours respectfully,

SATHMO.

November 30, 1825.

FURNITURE OIL.

SIR,—An excellent Furniture Oil will be obtained by simmering together, in an earthen pipkin, one ounce of roach alum and one pint of cold-drawn linseed oil, for a quarter of an hour. When used, it should be well rubbed off with a linen cloth, and by repeating the process you will in a few hours obtain a most beautiful and durable polish.

I remain, Sir,

Yours respectfully,

P— P—.

A METHOD FOR SECURING LINCH-PINS.

SIR,—The following plan, suggested to me by a kind and ingenious friend, respecting Linch-Pins for common purposes, I would offer for insertion in your Magazine, if thought worthy.

The proposer purposes to have a ring of tempered steel, with a spring catch, similar to those to which keys are affixed by housewives; this is to be inserted through a hole in each end of the linch-pin, and the spring is then to be closed. This, in my opinion, has two good qualities, viz. safety and cheapness: its cheapness is evident, and so, I think, are its safety and practicability.

I am, Sir, yours, &c.

FLINT.

Fore-street, Exeter.

THE PHENOMENON OF THE SUN DRAWING WATER.

SIR,—No doubt many of your readers have often seen a meteorological phenomenon, which is very common in showery weather, and generally when the sun is but a few degrees above the horizon—I mean that of the rays of the sun passing through the openings of the clouds, and radiating from that body towards the earth, at which time the sun is vulgarly said to draw water. Now these rays of light are mostly directed towards the horizon; but, on the contrary, I have sometimes seen them descend from the sun directly towards the zenith. How is this latter circumstance to be accounted for?

I am, Sir,

Yours respectfully,

TYRO.

QUERIES.

Among the varieties of Steel Pens, are there any on the principle of the *ruling* pen, consisting of two steel plates fixed into a brass handle, and regulated by a screw? For writing, the steel plates should be set at right angles, and a screw passed through them diagonally from left to right, about an inch from the end of the ribs. The screw, I imagine, would regulate the pressure properly for different kinds of writing, and prevent that irregular action of the nibs, by which common steel pens are rendered useless. T. B.

PRIZE CHRONOMETERS.

It would be seen from the Table given in our last, that out of forty-eight Chronometers which started for the Prizes to be awarded this year, twenty-one had been withdrawn; of which number (to continue the language of the Turf) some had run restive, and others bolted off the course. The following List will show the relative positions in which the remaining twenty-seven stood at the end of Ocober last, the sixth month of the competition.

	Numbers.	*Prize comp. time.*
French	$\frac{20}{3912}$	2″,57
French	975	3,24
Webster	638	3,50
Harris	678	3,96
Desgrange	35	4,17
Jackson	675	4,28
Cotterell	637	4,30
Taylor	602	4,46
Molyneux	862	4,89
Finer and Nowland	304	4,99
Cathro	1685	5,29
Jackson	512	5,32
Webster	710	5,47
Cathro	1703	6,23
Barwise	9294	6,81
Taylor	560	7,43
Cotterell	647	7,59
Porthouse	6281	7,66
M,Cabe	167	7,73
Desgrange	20	7,75
Elliott	947	8,23
Widenham	945	8,41
M'Cabe	168	9,06
Baker	782	10,10
Barwise	185	10,36
Lowden	2	10,41
Molyneux	850	11,27

It will be observed, that the prize computation, or time by which the prizes are to be awarded, is different from the mean daily rate, and the manner in which this difference is produced, it may be necessary to explain. To entitle a Chronometer to the first prize, its extreme average variation must not have exceeded six seconds; but for the second, a variation not exceeding ten seconds is allowed. In making this prize computation, the error of the mean daily rate is *doubled;* to that is added the mean of the extreme variation, and the joint product is the computation time. When the mean daily rates are all plus or all minus, the least variation is subtracted from the greatest; but, where they are both plus and minus, the

two extreme variations are added and then doubled. An example or two will make the matter more clear; we shall give that of the Chronometer which has varied least during the last six months, and that which has varied most.

French . . $\frac{20}{3912}$	Greatest mean daily rate	$\times$ 4″.75	
	Least ditto	$\times$ 4″.14	
	Real error of mean daily rate		61 $\times$ 1″.22
	Mean of extreme variation . . .		1″.35
			2″.57 Prize comput. time.

Ellicott. . 946	Extreme variation in the mean daily rate, *minus*	3″.64	
	Extreme variation ditto, *plus*	1″.81	
	Real error of mean daily rate	5″.45	$\times$ 10″.90
	Add mean of extreme variation		3″.80
	Prize computation time		14″.70

So that, while the former Chronometer stands in the prize list, as having varied, on an average, two seconds and fifty-seven hundredth parts of a second, the real error of mean daily rate has been only sixty-one hundredths of a second; and the latter, instead of having varied on the mean so much as 14″.70, has only varied five seconds and forty-five hundredth parts of a second.

We shall endeavour to lay regularly before our readers the official reports of each of the remaining six months, as soon as they appear.

Errata in Table of Prize Chronometers in our last.—In the list of the mean daily rate of Mr. Jackson's Chronometer, No. 512, the sign *plus* is omitted throughout. Mr. Smith's Chronometer . $\frac{7}{25}$, was withdrawn on the 30th, not 20th, of September.

ON IMPROVED MACHINERY IN CORN-MILLS.

Sir,—Prejudice is the great opposer to improvement, and so long as we entertain it, it will effectually preclude much advancement in science or general knowledge. An unwillingness to introduce what may have been invented elsewhere, is, I believe, and I am glad to acknowledge, fast giving way to the more enlightened desire of adopting whatever is advantageous, without regarding where it may have originated. I think this is chiefly to be attributed to the diffusion of information, through the medium of the press, for it is by that, principally, that we become acquainted with the mechanical inventions that take place in foreign countries; and, perhaps, no periodical work has contributed more to disseminate this important and useful knowledge than the Magazine of which you are the editor, during the short period of its career.

In making these observations, I would not be understood to assert, that what I am about to describe is not in operation or existence in this country (though I am not aware that it is), but that in these parts, at least, I believe it to be unknown; and imagining it to be an improvement

of considerable importance, I have thought it best to forward a description of it to you.

It consists in taking up the meal by machinery, more speedily and *without the assistance of any manual labour*. The process I am about to explain I have seen frequently, and know it to be effectual. The meal, as it comes from the stones, falls into a bin or trough about a foot wide, and of a suitable length, to catch the meal from two or three pair of stones, as may be contiguous. In this trough revolves an horizontal axle, of the length of the trough, which axle is surrounded by sheet-iron cogs, winding round it in a spiral direction its whole length. These cogs are not fixed straight across the axle, but a little obliquely, so as gradually to propel the meal to one end of the trough. When the meal has arrived at the receptacle at the end, it is taken at once to the top of the mill, by what is called the elevator, which is thus constructed:—It is a band of leather, say four inches wide, on which are placed, at short intervals, small tin buckets. This elevator passes round two rollers, one where the meal is, the other at the top of the mill, and each bucket, as it is dipped into the meal, takes up perhaps a quarter of a pint, which is deposited in a chamber, of ten or twelve feet diameter, upon the stage. In the centre of this area is a perpendicular shaft, with two arms projecting from it (called the hopper-boy) at right angles, about three or four inches from the floor; these arms are furnished with teeth, perhaps three inches apart, and in a diagonal with the arms, so as at each revolution to stir up the meal, and force it a little towards the centre.

The whole operation by the hopper-boy occupies about half an hour, during which time the meal becomes completely cooled and ready for dressing, as it lays very thin, and consequently has a large surface exposed to the air. As soon as it reaches a certain spot near the middle of the chamber, it falls through a spout into the flour-mill beneath, which is twenty feet long instead of six, as is usual here. The cloth is made of silk, which is found to be far preferable to wool or wire.*

I will now mention a superior mode of raising the stones to that which is customary here. It is done by means of a crane erected near each pair of stones. In the arm of the crane works a screw, which is turned by a short lever; to the bottom of the screw is attached a stout iron bar, bent in the form of a semicircle, which clasps over the stone, and is fastened to it by means of a bolt at each end; the upper stone is then raised, by means of the screw, completely off the other, and when at a suitable height, by merely pressing on one side, it is turned over; then, by altering the position of the crane, it may be lowered down in any convenient situation. This operation may be performed by one man in less time, and with greater facility, than by two or three men with blocks and pulleys. The stones are not suffered to run more than twenty-four hours.

W. C. H.

Kelvedon, Essex.

---

* At p. 288, vol. ii. Mech. Mag., will be found an account of the Baltimore Flour Mills, where the improvements pointed out by our Correspondent are exhibited on a very grand scale of action. —Edit.

TO CORRESPONDENTS.

Three interesting papers on Naval Architecture, by Mr. Bayley, G. M. H—n, and an Observer on Naval Improvement, shall have a place in succession after the continuation of Mr. Major's paper, which shall be given in our next.

Our able and indefatigable Correspondent, F. O. M., will oblige us by "the papers from the same source," to which he alludes.

**** Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th of each Month.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills*, *Jowett*, and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

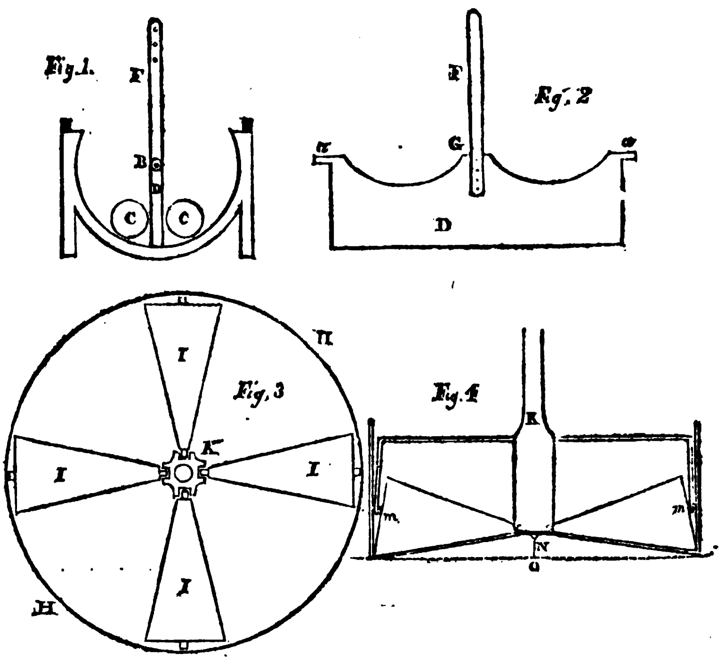
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 121.] SATURDAY, DECEMBER 17, 1825. [Price 3*d*.

"It is certainly delightful to look back, from the height of improvement upon which we now stand, at the infancy of human knowledge, and to observe how our rude ancestors struggled to subdue the hardships of their condition. Our minds are placed, by this means, in the track of invention, from whence we may perceive the first inflections, as it were, of those circumstances which generated the sciences and arts of life, and learn, by analogy, to discover if there be yet any hidden paths leading from our present position to new arts and improvements."—*Oriental Herald for October*, 1825, *article* '*Researches on Ancient Egypt.*'

OLD AND NEW INDIGO-MILL.



OLD AND NEW INDIGO-MILL.

Sir—Your Correspondent, "Blue Vat," in Number 114 of your valuable Magazine, complains very justly of his plan of grinding indigo; it certainly would require some ingenuity to invent one more tedious. Indigo Mills, such as he describes, were used by the dyers in this neighbourhood about twenty years ago, but are now laid aside. Those in general use at present are much better; but, in my opinion, there is yet ample room for improvement. The prefixed rough sketch will, perhaps, give some idea of the machine.

A, fig. 1, is an end-view or section of a strong cast-iron pan, or (as it is here called) cradle, of an oblong shape (say four feet long, two feet wide, and one foot nine inches deep); the inside is cast round or semi-cylindrical, the centre being at B. CC are two sets of cast-iron rollers, five or six inches diameter, each set being three in number and of unequal lengths, but extending together to each end of the cradle; between these sets of rollers is a cast-iron beam, D (see fig. 2), moving on axles, *a a*, corresponding with the centre, B, fig. 1. To this is fastened a wrought-iron shaft, F, at the middle, G, and extending about two feet above the top of the cradle. If an iron rod, six or eight feet long, be connected with the top of the upright shaft, F, and the other end attached to a crank, the beam, D, will be moved on its axles, *aa* (or B, fig. 1), and consequently the rollers will be propelled to and fro over the indigo. A mill of this description will grind about 100lbs. of indigo in two or three days, if previously soaked in hot water, and kept, while grinding, about the consistence of oil.

Thinking this an imperfect plan, I offer the following as an attempt at improvement:—

Fig. 3 is a bird's-eye view of a machine, consisting of a circular cast-iron pan, HH, from four to five feet diameter. IIII are four conical-shaped rollers of cast iron, the axles of which, at the smaller ends, run loose in the grooves of the cast-iron upright shaft, K. The rollers at the broad ends are propelled round the pan by four horizontal arms, attached to the shaft, K, at right angles, and extending to the axles of the rollers, *mm*, fig. 4. If the larger diameter of the rollers be supposed twelve inches, let the centre of the bottom, N, be elevated one-fourth of the diameter (viz. three inches) above the plane of the outer circle, O, and thus slope the bottom equally all round.

I have not seen or heard of an indigo-mill on this principle, but I think it would be superior to the former. Having less friction and a regular motion, it would require less mechanical power, and might be connected with other machinery requiring regularity, which is not the case with the cradle. As I think of setting up a machine on a plan somewhat similar, if any of your numerous scientific Correspondents will suggest an improvement, through the medium of your useful and interesting pages, it will greatly oblige,

Your very obedient servant,

A Dyer.

Armitage, near Huddersfield,
Nov. 3, 1825.

THE MANU-MOTIVE CARRIAGE.

Sir,—There is a *trifling* error made by W. B. in his article printed in your 119th Number.

"The screw" (says W. B.) "will enable a man to raise 288 *cwt.!*" independent of the power "*gained* by the combination of wheels!"—Taking the radius of the "handle," which W. B. has not stated, equal to the radius of the front-wheel, I calculate the force of the whole machinery, allowing the number of revolutions to be as stated by W. B., to be—

Power (say)	60
Weight	25

W. B. calculates

Power	a man's strength.
Weight	288 *cwt.!*

There is a slight variation, you see, Sir, between our two calculations upon the same piece of machinery; but I am inclined to think that you will find mine about correct. I understand the fundamental law of mechanics to be, that the *power* is to the *weight* inversely as their respective velocities.

I remain, Sir,
Yours respectfully,
R— H—.

ERRATUM—Page 111, vol. IV. line 6 from the bottom, for *crossing* read *coping*.

NEW NAUTICAL MACHINERY.

A man named Ignazio Roberto, of Troina, in Sicily, has invented a machine with which ships may be moved by hand, instead of steam, engines. Three persons, one of whom works an hour and rests himself two hours, are sufficient to move a vessel of 20 tons (40,000 pounds), and so in proportion to larger vessels. The expense of the machine is from 600 to 1000 ducats. He affirms that he has made repeated trials of it: he offers to apply it to any vessels for which it may be required, and indemnify the proprietor for the first two trials, if the machine should not act satisfactorily.—*French Paper.*

"MATHEMATICS FOR PRACTICAL MEN."

Dr. Olinthus Gregory, whose indefatigable exertions to make the truths of science more extensively applicable "to the use and service of mankind," are already so well known and deservedly appreciated, has, in the furtherance of the same laudable object, published a "Compendium of Mathematics for Practical men;" or, a "Common-place Book of Principles, Theorems, Rules, and Tables, in various Departments of Pure and Mixed Mathematics, with their most useful Applications, especially to the Pursuits of Surveyors, Architects, Mechanics, and Civil Engineers." That such a work has been much wanted, every practical man must have repeatedly felt—every one, at least (including, we should imagine, ninety-nine out of every hundred), whose course of knowledge has been from practice to theory. Mr. Brougham, in his "Practical Observations upon the Education of the People," has referred pointedly to the want of such elementary treatises as might "impart a knowledge of the most useful fundamental propositions (in Mathematics, Algebra, Geometry, and Mechanics), with their application to practical purposes;" and has exerted his powerful eloquence to stimulate the learned to supply the deficiency. Dr. Gregory, while adverting to this recommendation, dwells with great satisfaction on the fact, that, *before* it appeared, the greater part of his present work was already written. "I do not," he modestly says, "attempt to persuade myself that the present volume will be thought adequate to supply the desiderata to which these passages (of Mr. Brougham's pamphlet) advert; yet I could not but be gratified, after full two-thirds of it were written, to find that the views which guided me in its execution, accorded so far with the judgment of an individual distinguished, as Mr. Brougham was, in early life, for the elegance and profundity of his mathematical researches."

The only performances hitherto published, that bear any direct analogy to the present, are *Martin's Young Student's Memorial Book, Jones's Synopsis Palmariorum Matheseos,* and Brunton's Compendium of Mechanics (noticed in Mechanics' Magazine, vol. II. p. 292). But Dr. Gregory says of these very truly, "The first and last are neat and meritorious productions, but restricted in their utility by the narrow space into which they are compressed; and the other, written by the father of the late Sir William Jones, though an elegant introduction to the principles of mathematics, considering the time in which it was written (1706), is altogether theoretical, and is, moreover, becoming exceedingly scarce." It must be confessed, that

none of them supersedes the *necessity* of a Compendium like that which Dr. Gregory has here offered to the public.

With a view to the elementary instruction of those who have not previously studied mathematics, Dr. Gregory commences with two brief, but very masterly treatises on Arithmetic and Algebra. "A competent acquaintance with both of these arts is necessary to ensure that accuracy in computation which every practical man ought to attain, and that ready comprehension of scientific theorems and formulæ which becomes the key to the stores of higher knowledge;" and this competent acquaintance any person may readily acquire by the study of the treatises before us.

The subjects treated of in the rest of the volume, and with equal ability, are Geometry, Trigonometry, Conic Sections, Curves, Prospective, Mensuration, Statics, Dynamics, Hydrostatics, Hydrodynamics, and Pneumatics. This portion of the work is very similar in its nature to a syllabus or synopsis of a Course of Lectures on the same subjects. The definitions and principles are exhibited in an orderly series, but investigations and demonstrations only sparingly introduced. The chief circumstance in which it differs from a syllabus, is, that popular illustrations are more frequently introduced, practical applications constantly borne in mind, and many useful tables added, to save architects, mechanics, and civil engineers, the trouble of calculation.

But this work will be of use to others besides the numerous practical men, who are anxious to store their minds with scientific facts and principles. Teachers of Mathematics, and of those departments of Natural Philosophy which are introduced into our more respectable seminaries, will find in this volume an important intermediate auxiliary between the merely popular exhibitions of the truths of mechanics, &c., and the larger treatises, in which the whole chain of inquiry and demonstration is carefully presented, link by link. Students, too, who have recently terminated a scientific course, will find in this Commonplace Book a repository of principles and theorems, and of hints for practical applications, to which they may at all times refer with advantage.

The author tells us, that he has "aimed at no higher reputation than that of being perspicuous, correct, and useful." We can affirm with safety, that this reputation he has amply earned. In our next and succeeding Numbers we shall give some specimens of the work, which will fully justify us in recommending it; in the meanwhile, to our readers, as by far the ablest and most practically useful Compendium of Mechanics which has yet made its appearance.

BLASTING ROCKS.

SIR,—Observing an article in a late Number of your Magazine on the subject of Blasting Rocks, I beg to offer a few remarks on the subject.

In order that a given quantity of gunpowder may produce the greatest effect in blasting rocks, it is necessary that the powder be detained in the place where the explosion takes place till the whole is ignited. It has been found by experiment, that where the wad is driven out too quickly, great part of the powder is driven out with it, not having time to ignite; hence it is necessary to have a wad which fits closely, and yields slowly to the force of the powder, and thus gives the powder time to be ignited throughout before the space occupied by it is much enlarged. The best manner of effecting this is to close the channel with fine sand, without ramming it at all. (Vid. Encyclop. Brit. Suppl. vol. II.)

I remain, Sir,

Respectfully yours,

F. O. M.

Nottingham.

A QUESTION.

What is the composition of both the matches and the contents of the bottle into which the matches are dipped to be ignited, now generally in use to procure a speedy light?

NEW WEIGHTS AND MEASURES.

SIR,—Some time since I wrote an Essay on the subject of the Weights and Measures of this country, in which I exposed the various imperfections of the present system, with the reasons why it should be abolished, and also laid down the plan of a new one, which I think peculiarly combines the advantages of simplicity and perspicuity; but having subsequently learned that the present system is to be repealed, and a new one established, I have considered that there might be some things in the plan I thought of that are not comprised in the proposed system, and which could be introduced at the same time without increasing the confusion that will necessarily occur. I shall, therefore, take the liberty of laying them before you; but, in the first place, I consider that the coinage of this country is as censurable as the weights and measures, and therefore ought to be abolished. I shall not enter into detail of its numerous imperfections, but proceed to the description of a new table of money.

Proposed Table of Money.

10 mites	1 penny.
10 pence	1 shilling.
10 shillings	1 dollar.*
10 dollars	1 sovereign.

The sovereign to be a gold coin divisable into halves and quarters, and the mite an imaginary one, used only in particular cases where precision is required. Accounts should be kept in dollars, shillings, and pence; the first figure in every sum being pence, the second shillings, and all the rest dollars: thus—

d.	s.	p.
6543	2	1.

These figures at once explain the excellence of the decimal system, for, without the aid of reduction, we see there are six hundred and fifty-four thousand three hundred and twenty-one pence in the sum; for dollars can always be reduced into shillings by the addition of one 0, and into pence by two 0's; thus—5 dollars are 50 shillings, or 500 pence.

In compound addition we perceive with what ease and celerity the calculator can perform his task when the proposed currency is used; it is, in fact, nothing more than simple addition, as it is done exactly in the same manner: thus—

d.	s.	p.	
425	7	6	
703	8	5	
52	8	7	
146	9	4	
1328	6	2	*Ans.*

Compound subtraction is performed in the same way that simple subtraction is done, and with equal ease: thus—

	d.	s.	p.	
From	4684	2	4	
Take	3479	7	8	
Dollars....	1204	4	6	*Ans.*

The next rule is compound multiplication, which is worked in like manner to the simple rule: thus—1645 yards of cloth, at 4*d.* 2*s.* 5*p.* per yard.

```
 1645
  425
 ----
 8225
 3290
6580
 ----
6991,2,5 Ans.
```

The last rule that claims our attention is compound division, which is also performed in the same manner as the simple rule: thus—

```
    d.   s. p.
   4375  9  2 (by 6.
6) 4375  9  2
   ----------
    729  3  2 Ans.
```

* The dollar to be about the value of 4*s.* 6*d.* of the present currency.

```
         d.   s.
       9786   5, by 53.
53)    9786   5  (184d. 6s. 5p. Ans.
       53
       ——
       448
       424
       ——
        246
        212
        ——
         345 shillings.
         318
         ——
          270 for pence.
          268
          ——
           15
          ——
```

[This table of currency is equally useful in the more difficult rules of arithmetic, particularly in calculating interest, &c.]

I think that I have now sufficiently proved, to any unprejudiced mind, the excellence of the decimal syste of calculation; for, without half t.. intense thinking, without half the liability of making mistakes, and with double the facility, all pecuniary sums may be reckoned by it. Several of the most difficult rules may be made entirely unnecessary, and that simplicity, so requisite and so beautiful in account-books, may be introduced. I will now proceed to the tables of weights and measures, which I have constructed on the same principles as the money table.

Table of Weight.

10 grains	1 scruple.
10 scruples . . .	1 dram.
10 drams	1 ounce.
10 ounces	1 pound.
10 pounds . . .	1 stone.
10 stone	1 cwt.
10 cwt.	1 ton.

I propose that the grain of the above table should be equal in weight to the present apothecaries grain, and that all the other weights should be reckoned from it.

Table of Long Measure.

10 inches	1 hand.
10 hands	1 yard.
10 yards	1 chain.
10 chains	1 furlong.
10 furlongs . . .	1 mile.

I propose that one-third of the present inch should be the length of the new inch, which will allow the yard to be a convenient length for clothiers, half which length may be made into a closing rule for the use of mechanics.

Proposed Square Measure.

100 square	inches . . .	1 foot.
100	feet	1 plot.
100	plots . . .	1 rood.
100	roods . . .	1 acre.
100	acres . . .	1 circuit.

Proposed Liquor Measure.

10 pints	1 gallon.
10 gallons	1 barrel.
10 barrels	1 hogshead.

I propose that the new gallon sho..ld be similar to the old one, and that ..e size of the other measures should be calculated from it. I will here mention, that a great deal of the confusion in the old liquor measure, arises from the circumstance of the liquors being sold by the name of the cask, and not by the number of gallons or barrels that the cask contains; thus, a great number of measures have crep.. in that are entirely unnecessary, such as firkins, kilderkins, tierces, and puncheons, measures that only serve to make confusion. Instead of these:—Supposing the liquor to be beer, I would have it sold by the barrel, and have one-barrel casks, two-barrel casks, three-barrel casks, and so on; to sell it according to the quantity wished to be purchased, and have the price calculated from the number of barrels sold, and not by the size of the cask that contains them.

Proposed Dry Measure.

10 cups	1 peck.
10 pecks	1 bushel.
10 bushels	1 comb.

I propose that the above bushel should be equal in size to the bushel now in use, as it would be unwieldy if it were made larger, and that the other measures of this table should be calculated from it.

Such are the alterations that I wish should be introduced into the coinage, weights and measures, of this country. Satisfied in my own mind of their excellence, and the advantage which the community would derive from the use of them, I remit them to you for publication, desiring that they may help to smooth the asperities in the path of science, and be useful to mankind.

I am, Sir,

Your obedient servant,

J— H—.

Kelvedon.

SIR,—As the new Measures are to take place on the 1st of January next, it becomes a matter of some importance almost to every individual to be informed of the proportion the present measures bear to the new imperial measure.

On reading the Act there will be found some minute provisions relative to the temperature and weight of the atmosphere, which, for common practical purposes, may be altogether neglected.

It is well known that the present wine gallon contains 231 cubic inches; the dry gallon $268\frac{4}{5}$; the ale gallon 282; the new general imperial gallon, $277\frac{3}{10}$ nearly; the new general imp. bushel, $2218\frac{1}{2}$ nearly.

The above numbers may be reduced to others more suited for memory, and sufficiently accurate for all common practical cases, by the well-known method of continued fractions.

Thus, *six* of the present wine gallons are equal to *five* imperial; *thirty-three* dry gallons are equal to *thirty-two* imperial; *fifty-nine* ale gallons are equal to *sixty* imperial. From which it appears, that those farmers who do not wish to be at the expense of having their bushels enlarged, may, very correctly, make up the imperial or new general bushel by the *addition of one quart to each of the present Winchester bushels.*

I remain, Sir,

Yours respectfully,

B. BEVAN.

SCRAPS.

(To the Editor of the Mechanics' Magazine.)

NO. I.

May not the power derived from the heavy pendulum (see vol. III, page 2) be successfully applied to canal boats, by acting upon a paddle-wheel placed at the boat's stern? The saving would be great, and the only apparent objection seems to be the possible injury to the banks, and this, I fancy, exists only in theory.

NO. II.

Far be it from me to renew the 'Screw Question,' but, in the search for a mysterious cause, I think the simplest explanation has been overlooked. It is evident that the short driver cannot be so readily kept in the groove of the screw as the long driver; for if the hand varies from the axis of the screw equally in both instances, the angle of variation, and of course the facility of jumping out of the groove, will be greatest in the short driver; therefore, to counteract this facility, a portion of that force (which in the long driver is wholly exerted in the rotatory or proper direction) is, in the short driver, lost in a dead pressure to keep it down in the groove. The experiments of Nicol Dixon (not his theory) prove that elasticity has very little agency in the matter. Hence two corollaries.

1st. When a sufficiency of handle is had for readily preserving the position, no more is required. Many of the explanations given would prove too long a handle.

2nd. Although much power is thus lost upon the short handle, yet, in the way of brute force, the screw will, to a certain degree, be assisted by it, and therefore the short will perform a less number of evolutions

(though certainly more laborious) than the long driver in producing a given effect.

NO. III.

It appears that lead, in small quantities, is inflammable at the heat of a common candle. The heat is greatest at the exterior of the flame.

NO. IV.

Two hundred and forty (the number of pence in a pound) + half = 360: therefore, to any number of pence per day add half, and you have the sum per annum in pounds nearly. If you add for 5 days more, you have it exactly. Thus, one shilling per day is 18*l.* 5*s.* per annum, one shilling and sixpence per day is 27*l.* 7*s.* 6*d.*, twenty pence is 30*l.* 8*s.* 4*d.* five shillings is 91*l.* 5*s.*, &c.

NO. 5.

The peculiarity of the balance (adverted to at page 224, vol. IV.), may be thus illustrated:—Let a weight be hung from the beam between the pivot and the suspension point of the man's scale (say 20lb. at half-way between), and the whole then balanced. Let the man, instead of pressing against the beam, press against the weight (which is all the same) until it ceases to bear. Now it is evident that he has transferred the 20lbs. weight from *half-way* to the *end* of the beam or point of his own suspension, and as evident that his scale will preponderate. But, Sir, permit me to ask, how it happens that, when a man is balanced, *sitting*, his scale will descend as he rises into an erect position?

NO. VI.

In a warm climate most paper becomes unfit for use in one or two years, and, in some instances, the difficulty occurs still sooner. The ink soaks or spreads more or less by that time. The manufacture of a paper free from this liability is an object worthy of attention. It is said that American paper lasts longer in the East Indies than English. If this is true, why so?

NO. VII.

Some of your ingenious Correspondents may be able to suggest a simple mode of conveying canes from the top to the bottom of a steep hill, otherwise than by mules, the usual mode. It will be observed that canes are heavy; that they are loosely tied in small bundles, which it is expedient should not be loosed or the canes broken in the descent; also, that labourers must be employed in loading carts at bottom, which employment should neither be endangered or much interrupted. Gutters, suspended ropes, and even shute carts, have been occasionally used, but are neither general, nor are they, probably, of the best construction. I need not enlarge upon the benefit that would be conferred upon no small portion of West India agriculture by such a plan for this object as may be of sufficient merit and simplicity to be generally adopted. Such machinery should be capable of being occasionally removed, and applicable to different distances.

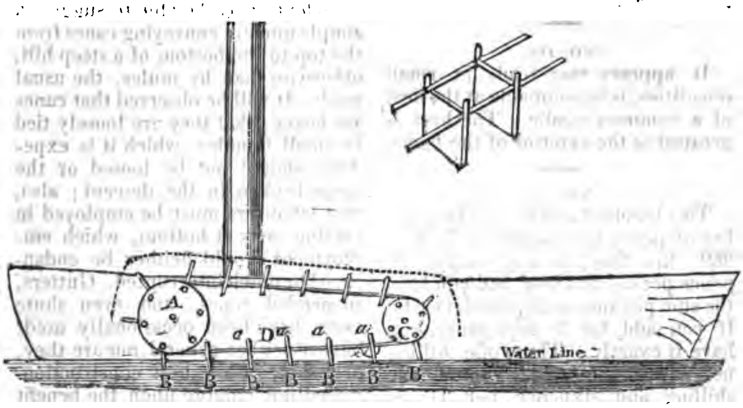
I am, Sir,
Your obedient servant,
A JAMAICA READER.

Jamaica, Oct. 6th, 1825.

VITALITY OF THE TOAD.

A few weeks ago, some miners at work at the Rough Hills Colliery, discovered in a solid piece of ironstone a small toad, which, on exposure to the air, exhibited symptoms of animation; and being put into water lived for about three weeks, growing to nearly double its size when first released from its confined cell, which was just large enough to contain its body. How long it remained in this situation, or by what means it became embedded in the mineral formation, must be entirely matter of conjecture, as it was found at a depth of 150 feet from the surface of the earth, and in a part of the pit which had never before been excavated. Between the layer of ironstone which contained the animal and that immediately over it, was a very thin stratum of a clayey substance.—During the time the toad remained in the water, it changed its colour from a dull brown to a bright amber, spotted with black, and is supposed to have died from want of food, having nothing but the water to subsist on. It is now preserved in spirits, and is in the possession of a gentleman of Wolverhampton.

IMPROVED PADDLE-WHEELS.



Sir,—Above I send you a sketch of what I take to be an improvement upon the Paddle-wheels of a Steam-vessel, which suggested itself to me in reading the article on the same subject in the last Part of your Magazine. I presume (as appears to be agreed) that the principal defects in the paddle-wheel now in use, are,

1st. The great loss of power occasioned by the float-boards raising a body of water in their ascent from the point of greatest depth; and,

2nd. The action of the boards, on entering the water, being exerted more in raising the vessel's head than in propelling her forward; but as the draught of the vessel is thereby lessened, and less surface exposed to the resistance of the water, it seems that the first defect is what chiefly merits attention.

I cannot see, then, in the sketch of your Correspondent, W— G+, that this is amended; for though he puts more float-boards into the water than ever act at once in the common wheel, thereby distributing the pressure which in it is borne nearly altogether by two boards, yet their ascent over the hinder wheel is still defective.

In the above sketch, A is the front wheel, to which the power is applied, and C is the hinder wheel, moved by the power of A, as communicated by the chain, D, by means of the projections, *a*, *a*, *a*, &c. taking into the two wheels. The hinder wheel, C, must be so much smaller than A, as that the chain, D, may make an angle with the surface of the water, and the bottoms of the boards, BBB, &c. leave the water before they turn on the hinder wheel; that is, the bottom of the wheel, A, must nearly touch the surface of the water, but that of the wheel C must be distant from the surface rather more than the depth of the float-boards.

The float-boards must be so inclined to the chain as to make a right angle with the surface of the water, in determining which there can be no difficulty, as the angle (x) will always be proportioned to the difference of the diameters of the two wheels, with the distance between them. Thus it will be seen, that the float, on reaching the point E, will exert its greatest force, which will gradually decrease till it leaves the water, and the vertical position of the float-board will be preserved throughout, and its stroke will be something similar to that of an oar. The details of the different parts I leave to those more conversant with these subjects, but shall be glad to hear that any advantage can be derived from the suggestion of

An Attorney's Clerk.

Alnwick, Oct. 5th, 1825.

MECHANICAL APPLICATION OF CONDENSED GASES.

SIR,—Amidst all the inventions and novel ideas to procure mechanical improvement in your Magazine, I believe it has omitted to mention that pointed out by Sir Humphry Davy, as a means of constructing, probably, an engine much smaller, infinitely more powerful, simple, and cheap, than any yet known; while the ingredients to work it could cost little, and the coals would be almost wholly saved. The President of the Royal Society proved, that carbonic acid gas, disengaged from chalk by means of the cheap ingredient, sulphuric acid, might be compressed into a liquid at 12° of Fahrenheit's thermometer, or 20° below freezing; but that, if then raised only 8° in temperature, the expansion gave a power equal to 13 atmospheres, or 195lbs. upon the square inch; and raised only 20°, or to 32°, the freezing point, the power became 36 atmospheres, or 540lbs. per square inch; and further, that, according as the degrees of heat increased, the power would increase in an equal proportion. A new and therefore nearly indefinite power is given, having none of the objections of extreme heat; and you would probably please your readers by referring to the Transactions of the Royal Society for the year 1823, in order that such valuable information and matter to work upon may not be neglected; at the same time the result of labour could no doubt be protected by a patent, and it is most probable that the Learned President and his able assistant, Mr. Faraday, would give every aid and correction required. Ice can be laid in store cheaper than coals, and in any quantity, while the heat to be applied to gain enormous power would be quite inconsiderable. The same gas would pass indefinitely through the operation of condensation and heating.

It may be useful to take this opportunity of adding, respecting steam-engines, that the French Government appointed three members of the Royal Institute to devise methods of safety in the use of them, when they published, in the *Annales de Chimie* of September last, the following Table, by which it will appear the heat of steam does increase in a regular quantity with the pressure.

Elasticity by Atmospheres.	*Pressure of Mercury.*	*Temp. by Centigrade Thermometer.*	*Pressure on centimetre, or about 2-5ths of a square inch.*	
1	0.76	100.0	1.033 Kilogrames, at	4lbs.
1¼	1.14	112.2	1.549	6lbs. 3oz.
2	1.52	122.0	2.066	8lbs. 3oz.
2½	1.90	129.0	2.582	10lbs. 4oz.
3	2.28	135.0	3.099	12lbs. 4oz.
3½	2.66	140.7	3.615	14lbs. 5oz.
4	3.04	145.2	4.132	16lbs. 6oz.

The Members then recommended, in addition to safety valves, that part of the top of the boiler should be made of metals, stamped, and capable of melting at any higher temperature than the boilers, when fixed, were intended to work with.

I am, Sir,

Your obedient servant,

TYRO.

Having only briefly noticed (not altogether overlooked) the new field of invention opened up by Sir Humphry Davy (vol. I. p. 68), we now subjoin an abridgment, from the Royal Transactions, of the papers referred to by our Correspondent:—

"Mr. Faraday, in the beginning of 1823, took advantage of the cold weather to procure crystals of hydrate of chlorine, and, at the request of Sir H. Davy, subjected them to the following experiment: After being dried as well as they could be by bibulous paper, they were introduced into a sealed glass

tube, the upper end of which was hermetically closed. On the tube being placed in water of 100°, the substance fused, and was filled with a bright yellow atmosphere. On examination, the tube was found to contain two fluids; one, about three-fourths of the whole, was of a pale yellow colour, having somewhat the appearance of water; the other was a heavy, bright yellow fluid, lying at the bottom of the tube, with no apparent tendency to mix with the former. As the tube cooled, the yellow atmosphere condensed with more of the yellow fluid, looking like chloride of nitrogene, and at 70° the pale portion congealed, though even at 30° the yellow portion did not become solid. From this experiment Mr. Faraday was led to suppose that the chlorine had been entirely separated from the water by heat, and condensed into a dry fluid by the mere pressure of its own abundant vapour. If this supposition were correct, chlorine gas, when condensed, should be compressed into the same fluid; and Mr. Faraday, subjecting this gas, after being completely dried, to a considerable degree of pressure in a tube connected with a condensing syringe, succeeded in forming the yellow fluid. This fluid is therefore considered, both by this gentleman and Sir H. Davy, as pure chlorine in a liquid state. By similar experiments, the learned President and his assistant succeeded in procuring liquid muriatic acid, liquid sulphurous acid, liquid sulphuretted hydrogen, liquid carbonic acid, fluid euchlorine, liquid nitrous oxide, and liquid ammonia. A number of experiments were also made on other gases, some of which, as hydrogen, oxygen, phosphuretted hydrogen, resisted condensation, though subjected to great pressure.

" Sir H. Davy, after stating that, owing to the laws according to which the elasticity of vapour increases under high pressure, some doubts must be entertained as to the economy of employing steam under great pressures at high temperatures, says, 'that no such doubts can be entertained with respect to the use of such liquids as require, even for their existence, a compression equal to that of the weight of 30 or 40 atmospheres; and where *common temperatures, or a slight elevation of them, are sufficient* to produce an immense elastic force; and when the principal question to be discussed is, whether the effect of mechanical motion is to be most easily produced by an increase or diminution of heat by artificial means?' Sir H. Davy then goes on to say, 'that he has made experiments on this subject, with the assistance of Mr. Faraday, and found that sulphuretted hydrogen, which condenses readily into a fluid at 3° Fahr., under a pressure which balances the elastic force of an atmosphere compressed to 1-14th, has its elastic force increased so as to equal that of an atmosphere compressed to 1-17th, by an increase of 47° of temperature. Liquid muriatic acid at 3 exerted an elastic force equivalent to that of an atmosphere compressed to 1-20th; by an increase of 22° it gained an elastic force equivalent to that of an atmosphere compressed to 1-25th; and by a further addition of 26°, an elastic force equivalent to that of an air condensed to 1-40th of its primitive volume.' 'Here, then,' says an able commentator on this statement, 'by alternately heating sulphuretted hydrogen gas up to 50, and cooling it down to 3 degrees, we generate a force equal to the pressure of three atmospheres. It is found,' he adds, 'that the elasticity thus developed varies in different gases, and that it is the greatest in those which are most dense. Carbonic acid, one of the heaviest gases, has in its liquid state an elastic force equal to 20 atmospheres at 12 Fahr., but at 32 it has a force equal to 36 atmospheres; so that by the addition of 20° of heat, we generate a force equal to 16 atmospheres, or 16 times as great as that of steam in low-pressure engines.' 'In applying the condensed gases as mechanical agents,' says Sir H. Davy, 'the apparatus must be at least as strong, and as perfectly joined, as that used by Mr. Perkins in his high-pressure engine; but the small difference of temperature re-

quired to produce an elastic force equal to the pressure of many atmospheres, will render the risk of explosion extremely small. And if future experiments should realize the views here developed, the mere difference of temperature between sunshine and shade, or air and water, or the effects of evaporation from a moist surface, will be sufficient to produce results which have hitherto been obtained only by a great expenditure of fuel.' After stating this application of his discoveries, Sir H. Davy adds, 'There can be little doubt that these general facts, of the condensation of the gases, will have many practical applications. They offer easy methods of impregnating liquids with carbonic acid and other gases, without the necessity of common mechanical pressure; they afford means of producing great diminutions of temperature, by the rapidity with which large quantities of liquids may be rendered aeriform; and as compression, like cold, prevents the formation of elastic fluids, there is great reason to believe that it may be successfully employed for the preservation of animal substances which serve for food.[a]"

THE EARTH AND SUN COMPARED.

Answer to the Question of Trigon, page 55.

Sir,—As an answer to the above question may have a tendency to convey more correct and enlarged views of the magnitude of our solar system to some of your readers, I beg leave to offer the following.

By referring to some of the modern elementary treatises on astronomy, it will appear that the diameter of the sun is about 885826 miles, and the diameter of the earth about 7914 miles. Now, it is well known to persons acquainted with the common rules of mensuration of solids, that the bulk of different spheres varies according to the cubes of their diameters; divide, therefore, the cube of the diameter of the sun by the cube of the diameter of the earth, and it will appear that more than *one million four hundred thousand* such globes as our earth would be required to form one equal to that of the sun.

Supposing this number of globes to be placed in a circular form in close contact, each globe to be 7914 miles in diameter, they would occupy the circumference of a circle more than 3530 millions of miles in diameter! being more than eighteen times the magnitude of the earth's orbit, and nearly equal to the orbit of Georgium Sidus, the most distant planet at present discovered in our system.

If these globes were placed in close contact on a plane, instead of a single ring, as above, they would fill a circle of nearly ten millions of miles in diameter!

When we compare the magnitude of the sun with our earth, and consider the magnitude of the earth in relation to the visible and inhabitable part, and this with its inhabitants, what ratio will these bear to the magnitude of the sun?

It is possible there are some persons so little acquainted with these matters, as to suppose the vast body of the sun created for the special purpose of giving light and warmth to a few animals that creep on the surface of our small planet.

I am, Sir,
Your hearty well-wisher,
B. Bevan.

[W. G. will see that we have preferred the more specific answer.—Edit.]

ON A DIGEST OF THE PLANS OF SHIPS IN THE BRITISH NAVY.

BY MR. JOHN MAJOR,
Foreman of His Majesty's Dock-yard, Chatham; late of the School of Naval Architecture.

[From the Annals of Philosophy.]

(*Concluded from p.* 62.)

The most important information we have respecting ships, is, that by increasing the principal dimensions of the various classes of ships, main-

taining a similarly constructed body, we have faster-sailing vessels. Conversely, if we similarly reduce the forms of ships, we have slower-going vessels. This is derived from the observation of facts; and although the principle leads to greater expenses, yet the superior quality of sailing renders the adoption of increased vessels desirable. By this means three ships may expedite what four others do: they would also have the advantage of overtaking all weaker enemies, and avoiding fleets and more powerful ones. The importance of such ships was never so much shown as in the late American war, where six large frigates eluded an English navy of six line-of-battle ships and thirty frigates. For the last 200 years the principle has been increasingly acted on; the French have always preceded us in it, and still continue to do so.

The above feature in vessels is not the only one to be considered; there are others necessary to make a good ship. A ship of the line may be built of better qualities than our 74-gun ships, and cost 6000*l.* less. This the Swedes have effected through the efforts of Chapman, their great theoretical constructor of ships. The Swedish 74 is 350 tons less in weight of hull, which would make the saving just asserted, being 1250 tons, while ours are 1600 tons in weight. They are sufficiently strong to stand the storms of the Baltic for twenty or thirty years without considerable repairs, and carry one-fifth more weight of metal. The plan of floatation is larger, and the midship section considerably less: they carry more sail, so that most probably they sail faster by two knots an hour; they also carry more ballast. From three different authorities of unquestionable verity, I have it in my power to confirm these assertions by presenting the analysis of each.

Chapman will be of immortal memory in ship-building. Perhaps, next to Bouguer, who calculated the metacentre, and first established the true method of stability, he has rendered most service to naval architecture. He had not the advantage of early initiation into mathematics, but in mature life he made considerable progress in them, and exercised his knowledge with great effect. He appears to have applied himself with much energy to the study of the formation of ships, by observing the effects of their different forms and equipments, after a similar plan to that laid down in this article, though not with such great advantages as improved calculations since afford, nor on so ample a field for observation as an analysis of the British navy. Neither did Sweden, in the time of Chapman, produce a *corps du génie maritime*, of thirty students of naval architecture, of good mathematical attainments, and who have been devoted to the study of all the problems of the theory, as well as being acquainted with the practice of ship-building.

The plan is equally applicable to steam-vessels. The French have already done this, by sending a mathematician of the name of Marastier over to America, in 1823, who has given the analyses of above one hundred steam-vessels, with a theory derivable from them.

The knowledge of the place of the centre of gravity of the ship and its contents, is of the greatest consequence. Most mathematicians have agreed that it is the centre of rotation in a ship. Without knowing it, the stability cannot be measured in any case. It has not been found in this country on more than two ships. By calculating the moments of the weights from a horizontal plane, and dividing by the whole weight of the ship, the point was ascertained on the Bulwark and on the Ajax, at the School of Naval Architecture, under Dr. Inman, in 1817. It was found to be at four feet five inches from the ports in each case nearly, or at one foot seven inches above the Channel service water-line. In obtaining the point in this way, the objections are, the method is very long, and the specific gravity of wood differing at sea, from absorption and exhalation, it is liable to errors. The vertical moments are, however, highly useful for more than one purpose. The time of its calculation for each ship was two persons, for a year each,

besides the assistance of labour in weighing many of the component articles, as stores, blocks, &c.

To find the point at any period of a ship's service, without regard to the specific circumstances of each component weight, must evidently be a most important acquisition. This was first proposed to be done by an experiment on the ship itself by Chapman, the eminent Swedish naval architect, in 1793. It has not been undertaken in this country for any ship. Chapman's mode of ascertaining the point has two objections belonging to it. He uses the metacentre as a measure of stability at an angle of 8° or 10°, which is decidedly erroneous. This is, however, easily corrected by substituting Atwood's equation of stability for it. The second objection is, that he has overlooked, apparently, the change of place of the centre of gravity of the ship by moving his guns on one side. This latter obscurity caused Mr. Charles Bonnycastle, late of the School of Naval Architecture, but now Professor of Natural Philosophy at Charlotteville, near Washington, Virginia, United States, who was the best mathematician belonging to our institution, to reject the proposition as illegitimate in its conclusions; and he bestowed considerable time in endeavouring to find it experimentally by other means. His attempts were, however, unsuccessful. The difficulty is here obviated by finding the new centre of gravity of the ship; and by investigating its line of transfer, we are enabled to ascertain the point in the upright position of the masts.

As Chapman's mode is performed by moving the guns and component weights of the ship, some naval architects have regretted the inconvenience of the method. This induced me to study another mode of effecting it, by inclining the ship by a horizontal force applied to the masts, by which the weights of the ship are not disturbed, augmented, or diminished: it is here appended.

For the resolution of the problem for finding the centre of gravity of the ship, by moving weights horizontally, let C A O D B* represent the bottom of the ship, A B its load water-line in the inclined position, C D that in the upright one. Suppose E to be the centre of gravity of the displacement, G that of the ship: let M be the place of the guns, which are transferred to N, in a direction at right angles to the masts.

Now the new centres of gravity of the displacement and ship may be found from the translations of the parts of them, the guns and newly immersed part, which latter must be equal to the emerged part. The lines of transfer are parallel with those of the parts, and in distance they are inversely as the weights. Suppose Q to be the new centre of gravity of the inclined displacement, and m to be that of the ship. Join $Q\,m$, and produce it to the plane of the masts. Now, since the ship is in a state of quiescence, $Q\,m$ is perpendicular to A B.

Draw G Z, E T, parallel to A B, and G R perpendicular to it. Then put V for the whole volume displaced of the ship in cubic feet of sea water; A for that of the immersed part by inclination, in the same measure; x for E G, the unknown distance of G from E; W for the weight of guns in cubic feet of sea water; d for M N, Δ for the angle of inclination; and b for the transfer of immersed part. We then have $G\,m = \frac{W\,d}{V}$ and $G\,Z = \frac{W\,d \,.\, \cos.\Delta}{V}$.

G Z is also equal to $E\,T - E\,R = \frac{b\,A}{V} - x \sin.\,\Delta$. Hence,

$$\frac{W\,d \,.\, \cos.\,\Delta}{V} = \frac{b\,A}{V} - x \,.\, \sin.\,\Delta.$$

$$x \,.\, \sin.\,\Delta = \frac{b\,A}{V} - \frac{W\,d \,.\, \cos.\,\Delta}{V}$$

$$x = \frac{b\,A - W\,d \,.\, \cos.\,\Delta}{V \sin.\,\Delta}.$$

To obtain the value of b, A and V, see Atwood's Stability.†

---

* The diagrams illustrative of this article have, unfortunately, not been engraved in time for the press this week, but shall be given in our next.—Edit.

† The theory of Stability, which consists in finding the distance of the vertical central line of buoyancy from the centre of gravity of the ship, is applied to all forms of ships by Atwood, in a disquisition on the subject in Phil. Trans. 1798, Part II. The investigation applies exactly to finding RT, which is equal to GZ above.

The other mode is for finding the centre of gravity of the ship from knowing the force of the sails, or any given power, with its place of action on the plane of the masts. It may be also used conversely. Thus, if we know the centre of gravity of the ship, we can tell the inclining power of the sails at a certain inclination.

Let a power, P, measured in cubic feet of sea water, incline the ship a known height from the centre of gravity of the displacement, which represent by a. Let Δ be the angle of inclination of the vessel, G the centre of gravity of the ship, E that of the displacement, Q the new centre of gravity of the displacement. Then using the same notation as in the last proposition, $GP = a - x$, RT or $GZ = \frac{bA}{V} - x$. **Draw G R perpendicular** to A B, and P R parallel to it. For **this expression of stability, see Atwood's** disquisition on the subject.

Now, since the power which inclines the ship is equal to the buoyancy of stability, the vessel being at rest, $P . \overline{a - x} . \sin.$ is equal to V . Or,

$$V . GZ = P . \overline{GR}$$

$$V . \overline{\frac{bA}{V} - x} \sin. \Delta = P . \overline{a - x} . \sin. \Delta$$

$$bA - x \sin. \Delta V = P a \sin. \Delta - P x \sin. \Delta$$

$$P x \sin. \Delta - x \sin. \Delta V = P a \sin. \Delta - bA$$

$$x . \overline{P . \sin. \Delta - V . \sin. \Delta} = P a \sin. \Delta - bA.$$

$$x = \frac{P a \sin. \Delta - bA}{P \sin. \Delta - V \sin. \Delta}.$$

The foregoing sketch of an analysis of the ships of the navy, with a view to derive from it a body of experience to guide the designs of his Majesty's ships, includes all the principal elements of a ship's composition. There is no new calculation introduced, except Dr. Inman's, for ascertaining the necessary form between wind and water to produce transverse motion in rolling, and the experiment for finding the centre of gravity of the ship and contents. A regard has been had to making the comparisons on a general and comprehensive scale, rather than on a minute reference to particulars, which do not materially affect the ship's qualities, and would render the calculations extremely diffuse. At a more advanced period of the science of naval architecture in this country, an analysis more refined in its parts may be used for comparing cases of particular interest, when the principal limits have become familiarly known.

The manner in which the inductive mode of philosophy is here applied to ascertain the principles of ship-building, from its extreme brevity, is more imperfect than it is thought the project itself is capable of being shown to be. In a future article some account of experiments on ships, to ascertain the relative velocity of the ship and wind, and the centre of mean resistance, will be given.

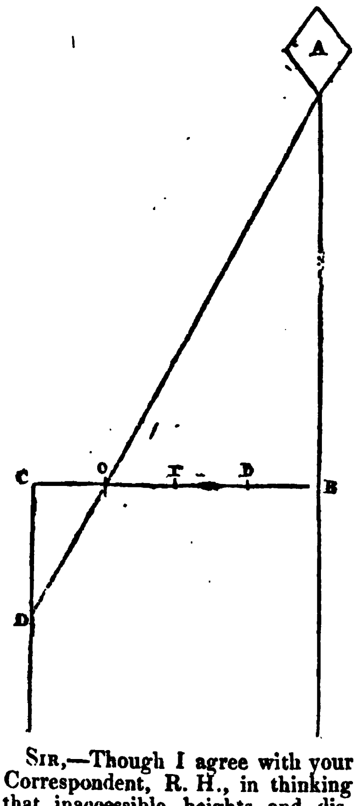
Our navy of England consists of 500 ships of war, of which 120 are line-of-battle ships. Of these, about two-thirds may be said to be "good-conditioned ships for sea." The extent of the calculations, therefore, appears very great. It must be remembered, however, that there are only six different rates, which have, for the most part, the same masts, rigging, guns, provisions, &c.; and that in some cases thirty or forty ships are built from the same draught. The variations are, therefore, not so great as might be imagined. Interpolations may also be used that will give results with a sufficient nicety.

The liberality which the Admiralty have extended to the institution to which I have the honour to belong,

renders obligatory every exertion on our part to promote the object of their Lordships in the improvement of the navy; and I shall be extremely happy if the foregoing disquisition should effect it in a humble degree.

ANSWER TO INQUIRY.

NO. 141.
MEASURING SHORT DISTANCES.



Sir,—Though I agree with your Correspondent, R. H., in thinking that inaccessible heights and distances cannot be measured from "one station" only, and even where there are two stations, great accuracy and good instruments are required; it may, nevertheless, be interesting to some of your readers to refer to a simple method laid down by Vauban, as tolerably accurate for the purpose of measuring short inaccessible distances, where proper instruments cannot be had.

Wishing to know the distance of the object A from B.—Place a picket at B, and another at C, at a few yards distance, making ABC a right angle; and divide BC into any number of equal parts. Make another similar angle at C, in a direction from the object, and walk along the line CD, till you bring yourself in a line with the object A, and any of the divisions (say O) of the line BC. Then, as CO : CD : : BO : BA.

I am, Sir, yours, &c.

W. H. B.

NOTICES TO CORRESPONDENTS.

The paper of Astronomicus, on the Solar Eclipses, reached us unfortunately at too late a period for insertion in this Number. We may mention in the mean while, on his authority, that the Solar Eclipse which is to take place in November next, will not, as stated in the paragraph quoted in our last Number, page 123, from a country paper, be *total* in any part of the world.

Communications have been received from the Mechanics' Institutions of Newport, Kirkheaton, Devonport, and Stonehouse—D. L. E. R. G.—Mr. Shuttleworth—An old Working Mechanic—S. Y.—Mr. Russel—M. G. R.—A Novice—Messrs. Brown—Dr. Burney—A Constant Subscriber—Oryt—F. O. M.—Mr. Tonkin—H. C.—Felix Ford—G. H. T.—B. Retlaw—J. S****e—Henry Ford—W. —M. Wills—James Ross—Y. Z.—H. W. (Newbury)—A Constant Reader—York—Robinson Crusoe—G. S. T.—T. A.—J. B.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LAÇEY, 55, Paternoster-row, London.
Printed by Mills, Jowett, and Mills (late Bensley), Bolt-court, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 122.] SATURDAY, DECEMBER 24, 1825. [Price 3d.

"We are born with faculties and powers capable almost of any thing, such at least as would carry us farther than can be easily imagined; but it is only the exercise of those powers which gives us ability and skill in any thing, and leads us towards perfection."—*Locke.*

DESCRIPTION OF CYLINDERS, ETC.

TO BE APPLIED ON MR. BROWN'S PATENT GAS PRINCIPLE TO THE WORKING OF A CARRIAGE;

BY MR. J. A. WHITFIELD, OF BEDLINGTON IRON WORKS.

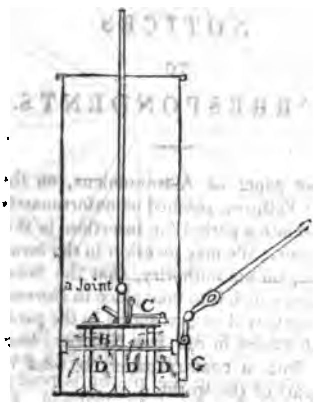


Fig 2

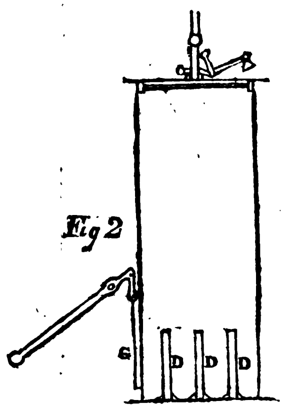


Fig 3

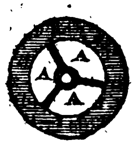


Fig 4

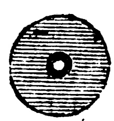
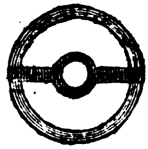
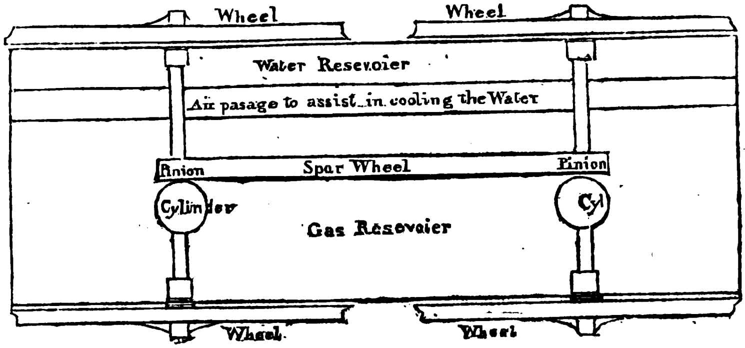
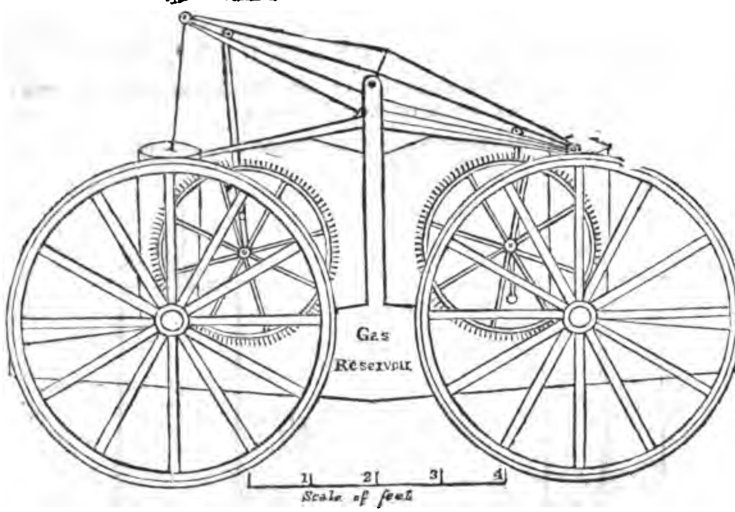


Fig 5







DESCRIPTION OF CYLINDERS, ETC.

Fig. 1 is an internal view of a cylinder. The piston in two parts, (see figs. 3 and 4). A is the upper part of the piston, standing open ready to ascend. B is the under part of the piston. C is a catch, to hold up part A, or figure 4. In this manner the piston ascends, so that the flame of gas may burn freely, as in the direction of the arrows.

Fig. 2 exhibits the piston ascended, and having struck the cross part at the top of the cylinder (see fig. 5), has shut the upper part of the piston. The cylinder is considered air-tight. The vacuum, at least the greatest part of the cylinder, say 4-5ths, is vacuum; on these 4-5ths the atmosphere presses with all its force, the piston descends and strikes the pillars, DDD, and opens the two parts, at which time the piston is ready to ascend, and fig. 1 to descend, &c.; GG are side valves, to stop the engine by the rush of air.

Fig. 3, a part of the piston which is made fast to the piston-rod end. AAA are openings through which the gas burns.

Fig. 4, the upper part of the piston. This is to slide three or four inches, as described in fig. 1.

Fig. 5, the cylinder top all open, the dark parts excepted.

The first figure on this page exhibits a bird's-eye view of a carriage, with the gas-machinery applied to it.

The other figure is an elevation thereof.

Respecting setting the engine in motion, &c. I will only say, in general, that it is by the opening and shutting of valves. The particulars it is unnecessary to state at present, as several parts of the engine, which must be described with working plans, are not attached to it.

Mr. Brown's Flying Gas Engine can be made, I should think, to go sixty miles per hour on a rail-road; however, I estimate that, by the plan here proposed, with a supply of gas every two hours, it would go twenty-five at least. The weight will not exceed 20 cwt., including gas and water. This motive power would, of course, act best on rail-roads, but it could be applied to turnpike-roads also. The cost would not be one halfpenny per mile for the gas.

MR. PERKINS'S STEAM-GUN.

The Duke of Wellington, and a numerous party of officers of engineers and artillery, paid a visit last week to Mr. Perkins's manufactory, in the Regent's Park, and witnessed a number of experiments with the new Steam Gun. At first, the balls were discharged at short intervals, in imitation of artillery firing, against an iron target, at the distance of thirty-five yards. Such was the force with which they were driven, that they were completely shattered to atoms. In the next experiment the balls were discharged at a frame of wood, and they actually passed thro' eleven one-inch planks of the hardest deal, placed at a distance of an inch from each other. Afterwards they were propelled against an iron plate one-fourth of an inch thick: at the very first trial the ball passed through it. On all hands this was declared to be the utmost effort of force that gunpowder could exert. Indeed, we understand that this plate had been brought specially from Woolwich, for the purpose of ascertaining the comparative force of steam and gunpowder. The pressure of steam employed to effect this wonderful force did not at first exceed 65 atmospheres, or 900lbs. to the square inch; and it was repeatedly stated by Mr. Perkins, that the pressure might be carried even to 200 atmospheres with perfect safety. Mr. Perkins next proceeded to demonstrate the rapidity with which musket balls might be projected by its agency. To effect this, he screwed on to the gun-barrel a tube filled with balls, which falling down by their own gravity into the barrel, were projected, one by one, with such extraordinary velocity, as to demonstrate that, by means of a succession of tubes, filled with balls, fixed in a wheel (a model of which was exhibited), nearly one thousand balls per minute might be discharged. In subsequent discharges or volleys, the barrel, to which is attached a moveable joint, was given a lateral direction, and the balls perforated a plank nearly twelve feet in length. Thus, if opposed to a regiment in line, the steam-gun might be made to act from one of its extremities to the other. A similar plank was afterwards placed in a perpendicular position, and, in like manner, there was a stream of shot-holes from the top to the bottom. It is thus proved that the steam-gun has not only the force of gunpowder, but also admits of any direction being given to it. The advantage, in point of economy, is thus estimated:—Suppose 250 balls are discharged in a minute by the single-barrel steam-gun, or 15,000 per hour, this, for 16 hours, would require 15,000 ounces of gunpowder per hour, or 15,000 pounds weight for the 16 hours. The expense of gunpowder being 70*s*. per cwt., or 35*l*. per thousand, is 525*l*. Mr. Perkins says that he can throw that number of balls in succession for the price of five bushels of coals per hour, or between 3*l*. or 4*l*. only for 16 hours.

SOLAR ECLIPSES.

SIR,—The paragraph quoted at page 123 of your last Number, is erroneous, in affirming that the Solar Eclipse, which will take place in November next, will be *total*. It will *not* be total in any part of the world. At and near London, there will be about 6½ digits eclipsed; and

in some parts of Germany, rather more than seven digits. In the northern part of Sweden, rather more than eight digits will be darkened; and that is the maximum.

The corresponding eclipse to that of 1764, according to the period of 18 years and 10 or 11 days, will occur May 15th, 1836. It will be central, in lat. 53°, and visible through a great portion of Europe, Africa, and Asia. This your readers may learn by consulting an interesting *Table of Solar and Lunar Eclipses, from the present Year to the End of the Nineteenth Century*, published in *The Imperial Almanack* for 1826.

On the morning of July 8th, 1842, there will be a large solar eclipse; 10¾ digits eclipsed at London.

On July 18th, 1860, another large solar eclipse; 11 digits eclipsed at London.

Also, in June 1927, and August 1999, there will be two large solar eclipses; in each of which more than 11 digits will be eclipsed in the neighbourhood of the British metropolis.

There will be other large solar eclipses visible in England, in the years 2075, 2093, 2146, 2187, 2200, &c.; but it would be quite useless to assign particulars of what will occur at so remote a period.

With many thanks for the instruction on various topics of incessant utility furnished by your valuable Magazine,

I remain, Sir,

Yours respectfully,

ASTRONOMICUS.

December 13th, 1825.

DOUBLE MORTARS.

SIR,—Seeing in an old Number a plan for a Double Mortar, I take the liberty of saying a few words on the subject, as the idea is, I think, founded on an incorrect principle. I am afraid your Correspondent will accuse me of sophistry, but I will nevertheless try to entangle him in a logical net.

1. I have no doubt that he will grant that his principle applies, supposing the bore to be square instead of circular.

2. If he grants this, he will also, I think, grant, that the magnitude of the division matters not.

3. Suppose the division infinitely thin, this reduces the case to the common mortar, with a bore twice the size of one of its branches.

Thus it is evident, that instead of any good being gained, the only effect is to double the reaction, by making the mortar throw two shells instead of one. The same is also manifest from the consideration, that as a greater effect is produced, in the direction of the motion of the shells, than when one only is thrown, a greater action will take place.

I am, Sir,

Your most obedient servant,

F. O. M.

Nottingham.

NEW MEASURES.

A Mr. Macgowan, in a letter to a Liverpool Paper, on the subject of the alterations in Measures which are about to take place, furnishes the following useful information:—

The imperial gallon contains 1-5th part more than the old wine gallon, and, consequently, is worth 1-5th more: thus, if the old gallon of wine costs 15*s.* the imperial will cost 18*s.*

The imperial contains 1-60th part less than the old ale gallon; therefore, if the old gallon is worth 2*s.* 6*d.* the imperial is worth 2*s.* 5½*d.*

The imperial bushel is 1-32nd part larger than the Winchester, and will, of course, cost 1-32nd part more: thus, if the old bushel of malt costs 10*s.* 8*d.* the imperial will cost 11*s.*

To bring wine gallons to imperial, deduct 1-6th: thus, 36 wine make 30 imperial.

To bring ale to imperial, add 1-60th: thus 15 ale make 15¼ imperial.

To bring Winchester to imperial bushels, deduct 1-32d part: thus, 20 Winchester bushels, or 80 pecks, make 19 bushels 1½ peck, or 77½ pecks imperial.

Mr. Macgowan also remarks, that if the imperial gallon is made, as to

the ale gallon, as 59 to 60, the result will scarcely vary one hundredth part from Gutteridge's tables.

CALCULATING INTEREST.

SIR,—Mr. G. U. A. (in Number 110 and some other previous Numbers of your excellent Magazine) has given what he calls a new method of Calculating Simple Interest for any given number of days. I do not intend to dispute the accuracy of the method, but I must beg leave to inform him that he very much deceives himself if he imagines he was the discoverer of the rule he has given for that purpose. In page 155, part first, of an Improved System of Arithmetic, by Mr. Daniel Dowling, Master of the Mansion House Academy, Highgate, published in 1818, he gives the following approximating equation, with a correction for calculating simple interest for any number of days at any rate per cent.

"Let p denote the principal,
d the number of days,
r the rate per cent.
and i the interest.

Then $\frac{1}{100,000}\left(2pdr + \frac{1}{3}2pdr + \frac{1}{30}2pdr + \frac{1}{300}2pdr\right) = i$ nearly; and, if one farthing be abated in every 10*l.* interest, the rule will be sufficiently correct for business."

When the rate is 5 per cent., then $2r = 10$; therefore dividing the numerator by $2r$, and the denominator by 10, the approximating equation becomes $\frac{1}{10,000}\left(pd + \frac{1}{3}pd + \frac{1}{30}pd + \frac{1}{300}pd\right) = i$ nearly; from which, abating one farthing for every 10*l.* interest, &c.

It, therefore, appears that the only difference between the two methods is in the quantity of correction. Now, as the first principles of both methods are precisely the same, we shall inquire how far the corrections bear upon the truth.

1st. If, from $\frac{1}{10,000}\left(pd + \frac{1}{3}pd + \frac{1}{30}pd + \frac{1}{300}pd\right)$, we subtract the 9600 part of itself (9600 being the number of farthings in 10*l.*), we shall have $\frac{3945189pd}{28800000000} = i$. Dividing both numerator and denominator by 3945189, we obtain $\frac{pd}{7300.03049} = i$ very nearly, which shows that the correction Mr. Dowling applies to his approximating equation brings out the interest very near the truth, the exact value of i being $\frac{pd}{7300}$. I shall only here briefly state (as I am afraid I may engross more space than the subject is entitled to) that the error produced from Mr. Dowling's correction is one farthing in defect in every 250*l.* of interest. His rule, as he states himself, is therefore sufficently correct for business.

2ndly. If, from $\frac{1}{10,000}\left(pd + \frac{1}{3}pd + \frac{1}{30}pd + \frac{1}{300}pd\right)$, we subtract the 10,000th part of itself, we obtain $\frac{pd}{7300.000073} = i$, which shows that Mr. G. U. A.'s correction brings out the interest extremely near the truth, the error being only one farthing in defect for every 104166*l.* 13*s.* 4*d.* of interest. His correction is, therefore, sufficiently accurate for any purpose whatever.

Now, as Mr. Dowling's approximating equation applies, whatever be the rate per cent., and as we have seen that Mr. G. U. A.'s correction is extremely near the truth, therefore by applying Mr. G. U. A.'s correction to Mr. Dowling's general approximating equation, we shall obtain an expeditious and accurate method of calculating the simple interest of any sum for any given time at any given rate per cent. per annum.

The general rule may be expressed as follows:—

Assume $\frac{1}{100,000}\left(2pdr + \frac{1}{3}2pdr + \frac{1}{30}2pdr + \frac{1}{300}2pdr\right) = a$.

Then $a - \frac{a}{10,000} = i$, very nearly; not differing one farthing in 100,000*l.* interest, whatever be the rate per cent.

When $r = 5$, the approximating equation becomes

$$\frac{1}{10000}\left(pd + \frac{1}{3}pd + \frac{1}{30}pd + \frac{1}{300}pd\right) = a,$$

and $a - \frac{a}{10000} = i$.

Example.

Required the interest of 13100,000*l.* for 80 days, at 3½ per cent. per annum.

Solution.

$2rpd = 7 \times 13100000 \times 80$	= 733600000	
1-3rd part	= 244533333	3
1-30th part	= 24453333	3
1-300th part	= 2445333	3
	100503.20000	
Deduct 1-10000th part	10.05032	
	100493.14968	

Or 100493*l.* 2*s.* 11*d.* 3.6928*qrs.*

We have extended the decimals in the above example to their full extent, in order to show how far the solution is true. Now, if the interest be calculated in the common way, it will be 100493*l.* 3*s.* 0*d.* 0.6575*qrs.*, so that the difference is only $\frac{9647}{10000}$ of a farthing.

I am, Sir, your obedient servant,

London, November 21st, 1825. G— S—.

IMPROVEMENT IN THE SPINDLES OF FLAX-SPINNING FRAMES.

A great improvement has been effected in the spindles of flax-spinning frames, by making the upper journal or bearance conical or tapering, in place of straight. In spindles adapted for the lighter sorts of flax-spinning, whose lengths are about 20 inches, the journals are made 1¾ long, 3-8ths diameter at the top, and 5-8ths at the bottom, tapering uniformly between, and having no collar or shoulder at either end. The journal runs in brass, of a corresponding bore, and of a cylindrical form, fitted into a cast-iron rail, 1¾ inches deep, accurately drilled out, and having a pinching screw, to keep the brass firm in its place. The lower end or foot of the spindle also runs in brass, fitted into a similar rail, with a pinching-screw, so that both brasses are easily slipt up or down, and there is consequently great facility for adjusting the spindles to uniformity of level, and for keeping the brass always nicely fitted to the spindle.

The advantages of this construction are, that the whole spindles of a machine may, at all times, with very little labour, be kept perfectly accurate in their position and steady in their motion—advantages of the first importance to spinning, and which result from this invention of conical journals with the simple and ingenious method of fitting the spindles to the frames; and, where great speed is required, the improvement is of increased importance, as no opening or vibration can take place on any part of the fixtures, and the spindle itself, from its tapering journal, becomes uncommonly stiff.

So considerable are the advantages in general of this invention, that it may be looked upon as the greatest improvement that has been effected in the form and fitting up of spinning spindles for many years; and from the rapidity with which it is coming into use in this quarter, it appears the public are not only aware of its utility, but eager to share in its advantages.

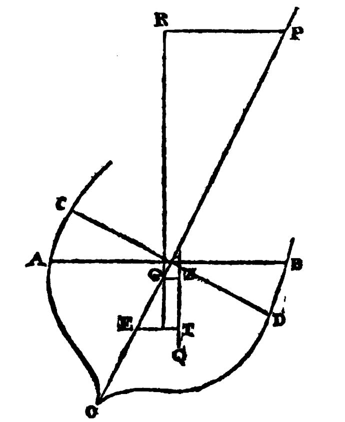
For the improvement in all its parts, the public are indebted to the ingenuity of Mr. David Cairncross, principal mechanic at the works of Messrs. James and William Brown, flax-spinners, Dundee.

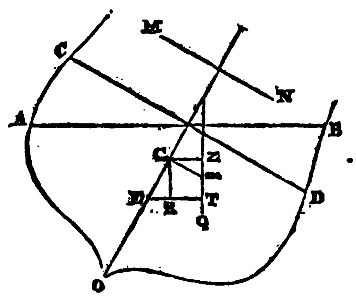
* * * * * *

Dundee, December 12th, 1825.

NAVAL ARCHITECTURE.

The following are the diagrams illustrative of Mr. Major's paper, which were omitted in our last.





SIR,—In your 110th Number, you favoured your readers with an extract from the Annals of Philosophy, of an article on "Naval Improvement, by Colonel Beaufoy, F.R.S." in which he says, with a great deal of truth, "that our acquaintance with the resistance of non-elastic fluids is yet in its infancy;" and therefore infers, that the ablest builder is at present ignorant of the curves best adapted for dividing the water. Had he simply said, that science had not yet enabled us to decide on the curves best adapted for dividing the water, he would have been nearer the truth. For if we investigate the matter, it will be found (in the majority of instances) that those builders whose vessels are the most in repute as fast sailers, are men who have not had the advantage of a scientific education, in the common acceptation of the term, but are men of natural genius and taste for naval architecture, and have mostly risen from the working class; not that I would imply that the scientific education of persons intended for ship-builders is useless, but, in general, those who possess such an advantage, endeavour to bring the practice to their preconceived theory, instead of examining how far their theory holds good in practice: whilst this is the case, we cannot expect much improvement in the models of our ships. Amongst the men whose vessels are celebrated as fast sailers, is Mr. Sainty, of Colchester. Of his abilities as a cutter-builder it is unnecessary for me to say any thing, as they are so well known to the Gentlemen of the Royal Yacht Club. He has remarked to me, that his ideas of the best model for sailing are quite at variance with those entertained by men of science, and that they are frightened when they see them on paper. In all his smack-rigged vessels the same principle is acted upon, although some have fuller bows and flatter floors than others. This principle he discovered by careful observation, joined with a natural genius. That he has adopted the right principle, is evident from the fact, that his vessels are the fastest of their size in the kingdom. His principle (for such I must term it, as he is almost the only person who has applied it to practice) is a simple one, and may be used in every case, whether for a row-boat, a merchantman, or a ship of the line.

I am not a mathematician, or I might, perhaps, attempt to describe the form and explain the powers of the principle, and point out the error that prevails so extensively in the construction of the model. But as a proof that it does not consist in what Colonel Beaufoy considers are essential to fast sailing, it is sufficient to mention, that all Mr. Sainty's vessels have what sailors term a good beam, and depend upon the peculiar

curve of their lines for their velocity.

I have frequently smiled to hear men of science talk of the resistance which a vessel meets with in passing through the water, as being in proportion to the area of the midship bend, as if the form of the bow and quarter was of trifling importance. It is evident this theory is erroneous, and opposed to facts; because we find that a vessel which is very much cut up amidships does not sail so much faster, in proportion to a full, flat vessel, with the same quantity of canvas, as we are led to suppose would be the case, if the theory of the men of science be correct; nor is it found that vessels having the same midship bend and bow, but differing in the form of the quarter, sail alike with the same canvas, which ought to be the case, if the area of the midship bend gives the true resistance, or any thing like it. I will mention an instance or two, that came under my own observation, which will prove, I think, that sailing powers do not depend exclusively on the length of the vessel, and the sharpness of the midship bend.

The first is that of a vessel which was very flat and wall-sided, and so full abaft, when built, as to swim five inches by the head when light. In this state, she would not go more than four, or four and a half miles per hour through the water with a good breeze. She was then hauled up, and the original quarter taken down and a fine one substituted in its place; after this was done, her speed was increased to eight or nine miles per hour through the water, with the same masts and sails, and instead of bringing up the rear as before, she was the headmost of the fleet.

In the other instance, two vessels were built, having the midship bend of the same form, in the same place, and of the same length, breadth, and depth, but differing in the form of their bows and quarters; the one carries considerably more than the other, and sails from one and a half to two miles per hour faster, although their masts are placed alike, and the quantity of canvas is the same. The curves of the fast vessel are formed on the same principle as those of Mr. Sainty's, and the curves of the other are agreeable to the customary mode.

With regard to the superior sailing of clencher-built vessels, it arises more from the curves being better adapted to divide the water, than from the circumstance of their being clencher-built; for in building a clencher-vessel, the boards naturally come to that form which is the best calculated for fast sailing; and if the same principle were applied to vessels generally, we should not have so often to complain of their being dull sailers.

I am sorry to have trespassed so long on your pages, but the subject is important in a national point of view; and if, by turning the attention of your readers to the subject, more correct principles be elicited, my end is answered.

I am, Sir,

Your humble servant,

George Bayley.

Ipswich.

LIFE-BUOY.

Sir,—As the means of preservation of human life must ever excite attention, I will beg your insertion of the following sketch and description of a Life Buoy, for the use of ships at sea, and even on shore, near any of our great basins and docks, where, if a person falls in, there is a high perpendicular wall around, and nothing to grasp hold of. One or two of these life-buoys might be kept on each side the dock or basin, ready to be cast in on an accident taking place.

The life-buoy generally used at sea, I call rather a death-buoy, prolonging your misery by continued efforts, and exhausting your strength to lay hold of a piece of wood, which, from its formation, as constantly recedes from you; before a boat can be lowered and come to you, your strength is gone, and down you go.

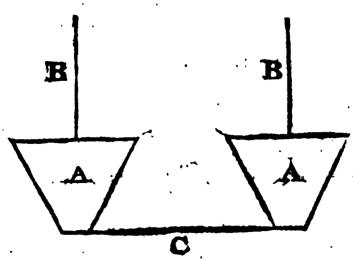
This buoy, I now propose, should be suspended in such a manner as instantly to be let go, which may easily be done by a loop or two, on hooks for the purpose, as a knife is not always at hand to cut a lashing, and, of course, time is lost in casting off the lashing.

I am, Sir,

Your humble servant,

G. M. N—R,

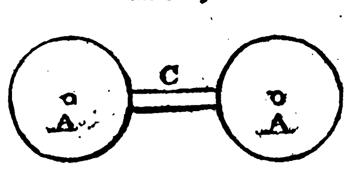
Lieutenant, Royal Navy.



Description.

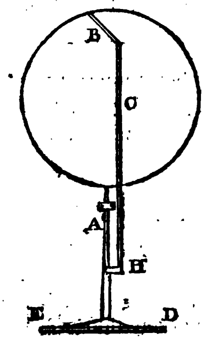
Have two pieces of light wood, as AA, in a conical form, as that presents the greatest surface, and consequently the greatest buoyancy in the least space. Let the two pieces of wood be of sufficient size to bear the weight of a man, and joined together by a double slight iron bar, from their cone, at such a distance from each other at their upper diameter, as to leave space for a man easily to pass between; he may then, by the support of his arms, placed on each surface, lift himself so as to gain a rest for his feet on the double iron, by which the two pieces, AA, are connected, and there remain in security, unfatigued, for a length of time.

The following is a Bird's-eye View of the Buoy.



In the centre of each piece, AA, have a small pole, as BB, for a man to grasp; also a flag, for more easily distinguishing its position in the water, with knotted pieces of rope suspended to its sides, to lay hold of. At night, when dark, burn a blue light, or throw a rocket in the direction of the buoy, which will reflect a light on it, and, with a tolerable sized flag on the buoy, make it more discernable. C is the double iron bar, which, by its weight, will also keep the buoy in its proper position in the water.

DAGGER RAT-TRAP.



Sir,—I flatter myself that I have hit upon a plan for a Rat-Trap, that would prove highly useful; it will require, however, some little nicety in the construction. The iron, C, must possess sufficient power to counteract the spring, DE, and at the same time be easily displaced by any pressure at C. This accomplished, which I think will be no difficulty, the advantages of the trap are obvious; as you must either kill the rat, or keep him in his hole. The square* is a strong piece of flat wood, having a circular hole in the middle, which is to be placed before the rat-hole, and should be surrounded by an iron rim. A is a dagger, having a handle to set it by; B, a strong piece of iron projecting a little from the top, joined to C by a hinge, which is a straight piece of iron coming down in the front of the mouth of the trap, resting upon the dagger at H, but so slightly

* Omitted by our draughtsman, who, in the drawing, has represented only what is included within the square. The handle of the dagger should also have been lower down, near H.

hitched, that the rat, in endeavouring to pass through the aperture, presses upon the iron at C, and throws it down; the dagger being then disengaged, is forced up by the spring, E and D, and pierces the rat.

Should you think the above worthy of a place in your valuable Magazine, by inserting it you will oblige

J. R. M.

Richmond, Oct. 15th, 1825.

BADNALL'S THROWING MACHINERY.

SIR,—I must beg of you to correct an error which, it seems, is copied from a Liverpool Paper, ascribing the invention of a new Throwing Machine to a man of the name of Scott; whereas, it is the sole patent and property of Mr. Badnall. Knowing that accuracy must be a desideratum with you, I thus give you an early opportunity of correcting the mistake, which may have arisen from Scott's having been the maker for Mr. Badnall.

I am, Sir,

Your obedient servant,

S. N. L.

December, 1825.

PROPERTIES OF NUMBERS.

[FROM DOCTOR GREGORY'S "MATHEMATICS FOR PRACTICAL MEN."]

1. An *unit*, or *unity*, is the representation of any thing considered individually, without regard to the parts of which it is composed.

2. An *integer* is either a unit or an assemblage of units : and a *fraction* is any part or parts of a unit.

3. A *multiple* of any number, is that which contains it some exact number of times.

4. One number is said to *measure* another when it divides it without leaving any remainder.

5. And if a number exactly divides two, or more numbers, it is then called their *common measure*.

6. An *even number* is that which can be halved or divided into two equal parts.

7. An *odd number* is that which cannot be halved, or which differs from an even number by unity.

8. A *prime number* is that which can only be measured by 1, or unity.

9. One number is said to be *prime* to another when unity is the only number by which they can both be measured.

10. A *composite number* is that which can be measured by some number greater than unity.

11. A *perfect number* is that which is equal to the sum of all its aliquot parts : thus, $6 = \frac{6}{2} + \frac{6}{3} + \frac{6}{6}$.

Prop. 1. The sum, or difference, of any two even numbers, is an even number.

2. The sum, or difference, of any two odd numbers, is even; but the sum of three odd numbers, is odd.

3. The sum of any even number of odd numbers is even; but the sum of any odd number of odd numbers is odd.

4. The sum, or difference, of an even and an odd number, is odd.

5. The product of an even and an odd number, or of two even numbers, is even.

6. An odd number cannot be divided by an even number without a remainder.

7. Any power of an even number is even.

8. The product of any two odd numbers is an odd number.

9. The product of any number of odd numbers is odd; and every power of an odd number is odd.

10. If an odd number divides an even number, it will also divide the half of it.

11. If a number consist of many parts, and each of those parts have a common divisor, d; then will the whole number, taken collectively, be divisible by d.

12. Neither the sum nor the difference of two fractions, which are

in their lowest terms, and of which the denominator of the one contains a factor not common to the other, can be equal to an integer number.

13. If a square number be either multiplied or divided by a square, the product or quotient is a square; and, conversely, if a square number be either multiplied or divided by a number that is not a square, the product or quotient is not a square.

14. The product arising from two different prime numbers cannot be a square number.

15. The product of no two different numbers prime to each other can make a square, unless each of those numbers be a square.

16. The square root of an integer number, that is not a complete square, can neither be expressed by an integer nor by any rational fraction.

17. The cube root of an integer that is not a complete cube, cannot be expressed by either an integer or a rational fraction.

18. Every prime number greater than 2, is of one of the forms $4n+1$, or $4n-1$.

19. Every prime number greater than 3, is of one of the forms $6n+1$, or $6n-1$.

20. No algebraical formula can contain prime numbers only.

21. The number of prime numbers is unlimited.

22. The first twenty prime numbers are 1, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, and 67.

23. A square number cannot terminate with an odd number of cyphers.

24. If a square number terminate with a 4, the last figure but one (towards the right hand) will be an even number.

25. If a square number terminate with 5, it will terminate with 25.

26. If a square number terminate with an odd digit, the last figure but one will be even; and if it terminate with any even digit, except 4, the last figure but one will be odd.

27. No square number can terminate with two equal digits, except two *cyphers* or two *fours*.

28. No number whose last, or right-hand, digit is 2, 3, 7, or 8, is a square number.

29. If a cube number be divisible by 7, it is also divisible by the cube of 7.

30. The difference between any integral cube and its root is always divisible by 6.

31. Neither the sum nor the difference of two cubes can be a cube.

32. A cube number may end with any of the natural numbers, 1, 2, 3, 4, 5, 6, 7, 8, 9, or 0.

33. If any series of numbers, beginning from 1, be in continued geometrical proportion, the 3rd, 5th, 7th, &c. will be squares; the 4th, 7th, 10th, &c. cubes; and the 7th, of course, both a square and a cube.

34. All the powers of any number that end with either 5 or 6, will end with 5 or 6, respectively.

35. Any power, n, of the natural numbers 1, 2, 3, 4, 5, 6, &c. has as many orders of differences as there are units in the common exponent of all the numbers; and the last of those differences is a constant quantity, and equal to the continual product $1 \times 2 \times 3 \times 4 \times \ldots\ldots \times n$, continued till the last factor, or the number of factors be n, the exponent of the powers. Thus,

The 1st powers 1, 2, 3, 4, 5, &c. have but one order of
differences 1 1 1 1 &c. and that difference is 1.

The 2d powers 1, 4, 9, 16, 25, &c. have two orders of
differences 3 5 7 9
2 2 2
of which the last is, constantly, $2 = 1 \times 2$.

The 3d powers 1, 8, 27, 64, 125, &c. have three orders of
differences 7 19 37 61
12 18 24
6 6
of which the last is $6 = 1 \times 2 \times 3$.

In like manner, the 4th, or last, differences of the 4th powers, are each $= 24 = 1 \times 2 \times 3 \times 4$; and the 5th, or last differences of the 5th powers, are each $125 = 1 \times 2 \times 3 \times 4 \times 5$.

36. If unity be divided into any two unequal parts, the sum of one of those parts added to the square of the other, is equal to the sum of the other part added to the square of that. Thus, of the two parts $\frac{1}{5}$ and $\frac{4}{5}$, $\frac{1}{5} + (\frac{4}{5})^2 = \frac{4}{5} + (\frac{1}{5})^2 = \frac{21}{25}$: so, again, of the parts $\frac{2}{5}$ and $\frac{3}{5}$, $\frac{2}{5} + (\frac{3}{5})^2 = \frac{3}{5} + (\frac{2}{5})^2 = \frac{19}{25}$.

For the demonstrations of these and a variety of other properties of numbers, those who wish to pursue this curious line of inquiry may consult Legendre "Sur la Theorie des Nombres," the "Disquisitiones Arithmeticæ" of Gauss, or "Barlow's Elementary Investigation of the Theory of Numbers."

Also, for the highly interesting properties of *Circulating Decimals*, and their connexion with *prime numbers*, consult the curious works of the late Mr. H. Goodwin, entitled "A First Centenary," and "A Table of the Circles arising from the Division of a unit by all the Integers from 1 to 1024."

STEERAGE OF CRAFT DOWN STREAM.

Sir,—Although it is well known to every bargeman on the River Thames, that when his vessel is floating with the stream, her velocity (a-head) *through* the water is sufficiently great to subject her to the influence of the rudder, yet very few, I believe, are acquainted with the cause.

If your Correspondent, A. B., vol. v. page 102, will consider a stream, what we know it is, *an inclined plane*, he will no doubt admit that the barge, having acquired the velocity of the stream, is yet impelled forward by the power of gravitation, and that the velocity of the barge *through* the water will continue to increase, until the power of gravitation is counterbalanced by the resistance which the vessel meets with in her passage through the water.

According to this theory, the greater the tonnage of the vessel, the greater will be the velocity acquired, the power being in proportion to the weight, the resistance in proportion to the surface: and this we find is the case, the larger craft invariably leaving the smaller behind them.

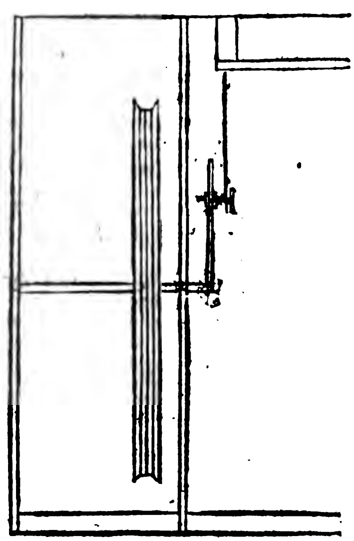
I remain, Sir,

Yours respectfully,

Henry Russell.

City Road, London.

REGULATING THE CRANK OF FOOT-LATHES.



Sir,—For leisure-hour amusement I have used a Foot-Lathe for more than forty years, and adopted a much more simple method of altering the length of the crank than that proposed by W—, in page 209, vol. iv. The wheel (see the above sketch) runs between two supports, and one end of the shaft projects through the fore-support, and there forms a right angle; a pin slides along the part, and fixes at any place by a screw;

on this pin the foot-board is hung. Whether this be worse or better than the eccentric-wheel, is left for others to determine.

Permit me to refer R— H—, page 217, vol. IV. on the Measuring of Heights, to Dr. Hutton's Mensuration in Theory and Practice, page 80, which, being more early consulted, might have saved him "time and reflection."

I am, Sir,

Yours most respectfully,

K. CHILD.

Halifax, 19th August, 1825.

SUN DRAWING WATER.

SIR,—Tyro's question, in page 125, of Number 120, were it not for the *luminous* subject on which it is advanced, might be jocosely answered by a quotation from Hudibras:—

"He could raise scruples *dark and nice*,
And then resolve them in a trice."

For it is clear, on reading his question, that he understands, that the phenomenon which he alludes to is effected by the light of the sun on atmospheric medium, and, were it not for the interposition of clouds, would exhibit one general emanation of light, diverging regularly from all points of the luminary. If, therefore, some of the "intercepting clouds" float *apparently* higher in the hemisphere than the angle under which the sun is seen at the time, the beams of light to which, he *truly says*, the vulgar give the name of "*the sun's drawing water*," must as certainly appear to ascend, as those which he agrees to understand descend. ORYT.

[Tyro will find the matter further explained in Mr. Hayter's excellent work on Perspective, 4th edit., bottom of page 112 and top of page 113.—EDIT.]

"PERPETUAL MOTION" *not* "DISCOVERED."

SIR,—Permit me to offer a few brief remarks in reply to Alpha's letter, entitled "Perpetual Motion Discovered," which appeared in your Magazine of the 10th instant, Number 120.

Alpha certainly deserves no small degree of praise for the very ingenious application which he has made of a false principle; but had he considered that the upward pressure of fluids is always equal to their downward pressure, and that, therefore, the upper board of his moveable frame would be pressed upwards in the same proportion that the lower board was pressed downwards, he certainly would not have imagined himself justified in exclaiming—ευρηκα, ευρηκα (I have found it! I have found it!). When Alpha can prove that a man in a closed hogshead, placed in a balance, will weigh more by pressing against the bottom of the hogshead than he will whilst remaining at rest, then I will admit, that he has discovered that which will prove infinitely more valuable than the realization of all those *golden* dreams which have been dreamt on the subject of the visionary philosophers' stone.

OMEGA.

Redruth.

COLOURING GOLD TRINKETS.

SIR,—In colouring trinkets of gold, I have followed a plan recommended in Dr. Brewster's Journal, namely, that of boiling the articles in a solution of muriate of ammonia. This, no doubt, *will* colour them, but leaves them of a very *pale* hue. Now, would some of your more intelligent Correspondents inform me of a method how to make them a *darker* or *richer* colour, or if it is the right way I pursue altogether? I should be glad, also, to know the *proper* method of compounding the solder for making the articles. I have made solder from the directions laid down in the Encyclopædias, but, when I come to use it, it takes so much heat to melt it, that it sometimes melts the article altogether.

Your insertion of the above will much oblige, Sir,

Your constant reader,

H— W—.

Newbury, November 23, 1825.

P.S. I hope your Correspondents will not be so *close-fisted* as Niloc Esor observed in a former Number, on "refining gold," as to refuse the information desired.

RESULTS OF A METEOROLOGICAL JOURNAL, FOR NOVEMBER, 1825.

Kept at the Observatory of the Royal Academy, Gosport, Hants,

BY DR. BURNEY.

		Inches.			
Barometer	Highest	50.30,	November 23rd	—Wind	W.
	Lowest	28.60,	10th		N.E.

Range of the Mercury............ 1.70.

	Inches.
Mean Barometrical Pressure for the Month	29.722
—— for the Lunar period, ending the 10th inst.	29.786
—— for 13 days, with the Moon in North declination	29.870
—— for 17 days, with the Moon in South declination	29.702
Spaces described by the rising and falling of the Mercury	9.890
Greatest variation in 24 hours	0.760
Number of changes	24

Thermometer	Highest	60°,	November 1st and 2nd	—Wind	W.
	Lowest	29	12th,		N.

Range 31
Mean temperature of the external air....44.97
—— for 30 days, with the Sun in Scorpio..46.32
Greatest variation in 24 hours 22.00
Mean temperature of spring water at 8 A.M. 53.84

DE LUC'S WHALEBONE HYGROMETER.

	Degrees.	
Greatest humidity of the Air	100	in the morning of the 10th.
Greatest dryness of ditto	59	in the afternoon of the 12th.
Range of the Index	41	
Mean at 2 o'clock P.M.	76.0	
—— 8 o'clock P.M.	82.5	
—— 8 o'clock P.M.	82.2	
Mean of three observations each day, at 8, 2, and 8 o'clock	80.2	

Evaporation for the Month .... 1.400 inches
Rain in the Pluviameter near the ground . . 4 725
Rain in ditto 23 feet high 4.185
Prevailing Winds, S.W. and W.

A SUMMARY OF THE WEATHER.

A clear sky, 4; fine, with various modifications of clouds, 10; an overcast sky, without rain, 8½; rain, 7½.—Total, 30 days.

CLOUDS.

Cirrus,	Cirrocumulus,	Cirrostratus,	Stratus,	Cumulus,	Cumulostratus,	Nimbus.
13	10	26	1	12	21	24

A SCALE OF THE PREVAILING WINDS.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Days.
3½	1	1	½	1	6	9	8	30

The weather this month has been mostly wet and stormy, very variable in the temperature and pressure, and the lower stratum of air generally in a state of condensation, accompanied with unwholesome currents of winds, which were sometimes opposite and at other times crossed each other at right angles. The effects of this weather upon the human constitution have been, in many instances in this neighbourhood, severe attacks of rheumatism and bad colds. During the 8th, 9th, and 10th instant, 2¼ inches of rain and hail fell here, with a low barometer, and piercing winds from the N. and N.E. During these heavy gales many vessels were wrecked along the western coast, and a great part of their crews drowned. In the night of the 28th and morning of the 29th, much lightning and thunder occurred here, with torrents of rain and hail. The peals of thunder being mostly in the zenith as the storms passed over, they were therefore near and very loud, the lightning often forked, and the hailstones of a large size lay in heaps in the gutters several hours after their descent. The contrast between the lightning and a lighted candle in a bed-chamber was remarkable; the former appeared bright and vivid, the latter was of a dull red colour. The awfully grand appearance of the clashing elements was observed nearly at the same time at Winchester, in the Isle of Wight, Portsmouth, &c. but earlier at Guilford, notwithstanding the wind here was from the S.W. point, therefore it is probable that the storm was brought on by reverse winds.

The mean temperature of the external air this month is comparatively low, so cold a November not having been felt since that in 1820; and it is 3½ degrees lower than the mean of that month for the last nine years. There was a difference of 21½ degrees in the mean temperature of the air between the 2nd and 12th.

In consequence of the many frosty nights and rainy days, spring-water has decreased in temperature 2¼ deg. this month. The *maximum* temperature of the air has occurred by seven different nights instead of the days. The atmospheric and meteoric *phenomena* that have come within our observation this month are two lunar halos, fourteen meteors, two rainbows, lightning and thunder in the night of the 28th and morning of the 29th, and ten gales of wind or days on which they have prevailed, namely, two from N.E., one from S., six from S.W., and one from the W.

INQUIRIES.

NO. 169.—BIRD CATCHING.

Sir,—A young gentleman who is fond of the study of Natural History, begs I will request some of your Correspondents to give him, in your useful work, an account of the nets, with their necessary appendages, as used by our most experienced bird-catchers, for taking goldfinches, linnets, and other singing birds; and, if it is not asking too much, he would like to have the description accompanied with a drawing, exhibiting the whole when laid out ready for use. The gentleman has seen the account of these nets, with the accompanying drawing, in the Encyclopædia Perthensis, but he does not consider either sufficiently explicit.

I remain, Sir,

Yours respectfully,

An Ornithologist.

NO. 170.

EXPANSION OF DEAL RODS.

Sir,—Having observed, in Dr. Hutton's Course, vol. iii. page 119, that General Roy declined the use of *deal rods* as a means of measuring a base line, when he was about to determine the length of a degree of the meridian, on account of their expansibility and contraction, occasioned by the "moisture and dryness of the air," I should feel obliged if, through the medium of your very valuable and highly scientific Magazine, I could be informed the ratio in which *deal rods* contract and expand.

I am, Sir,

Your most obedient servant,

James Thompson,
Carpenter.

North-street, Penzance.

ANSWERS TO INQUIRIES.

NO. 166.—MORTAR FLOORS.

SIR,—In answer to "A Mason," who desires to know the preparations for making Mortar Floors, I beg to offer the following particulars :—

Let him excavate the earth for the intended floor to the depth of one foot six inches, and not less; fill up the excavation again to within four inches, with brick-bats and dry rubbish. Then, to prepare the mortar, take two parts of clean sharp river sand, and one part of stone lime, and add a little small coal or ashes; let this compound be well worked together, and made very soft; it must afterwards lay for a month to temper, but, in the course of that time, it should be well worked and turned over three or four times; at the end of the month this composition should be laid over the surface smooth and level, not less than four or five inches thick, to make a good floor. As soon as the composition is sufficiently dry to bear a person to walk over it, it should be well trodden; after that take a beater and beat it over once a-day, and, as it grows harder, repeat this operation two or three times, until it is sufficiently dry and has done cracking. Finally, take a plasterer's hand-float, and float it over well, to give it a smooth surface; after which let the floor be washed over with hot water three or four times a week, until it becomes quite hard.

I remain, Sir,
Your obedient servant,
A YOUNG BRICKLAYER.

November 9th, 1825.

NO. 155.
COVERING FOR FLAT ROOFS.

[*Second Answer.*]

SIR,—In reply to Inquiry 155, I beg to mention that a very cheap and durable covering may be made for a flat roof by caulking it and covering it with strong and coarse brown paper, daubed over with pitch or tar, over which, when dry, a layer of clean-washed pebbles should be placed, to keep off the heat of the sun and beating of the rain.

I am, Sir,
Your most obedient servant,
W. H. B.

CORRESPONDENCE.

The paper of W. C. H. is intended for insertion.

Communications received from the Hackney Literary and Mechanic Institution—Clero—Mechanicus—W.—J. D. S.—V.—M. H. S.—A Constant Reader—Aster—T. N.—T. J.—W. J.—T. G.—Z.—J. K. S.—S. E. Ash—J. B.—Monad—An old Subscriber—F. O. M.—A Schoolboy—Aurum—A Subscriber from the beginning—Mr. Hubert—A Country Mechanic—M. G. R.—Luke Broadbent—Olinthus—W. B.—Wm. Tonker—An old Working Mechanic—A Novice—H. C.—J. O.—G. H. I.—Michilt—I. E.—J. Long—John Orchard—A distant Inquirer—W. Smith.

*** Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th of each month.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by MILLS, JOWETT, and MILLS (late BENSLEY), Bolt-court, Fleet-street.

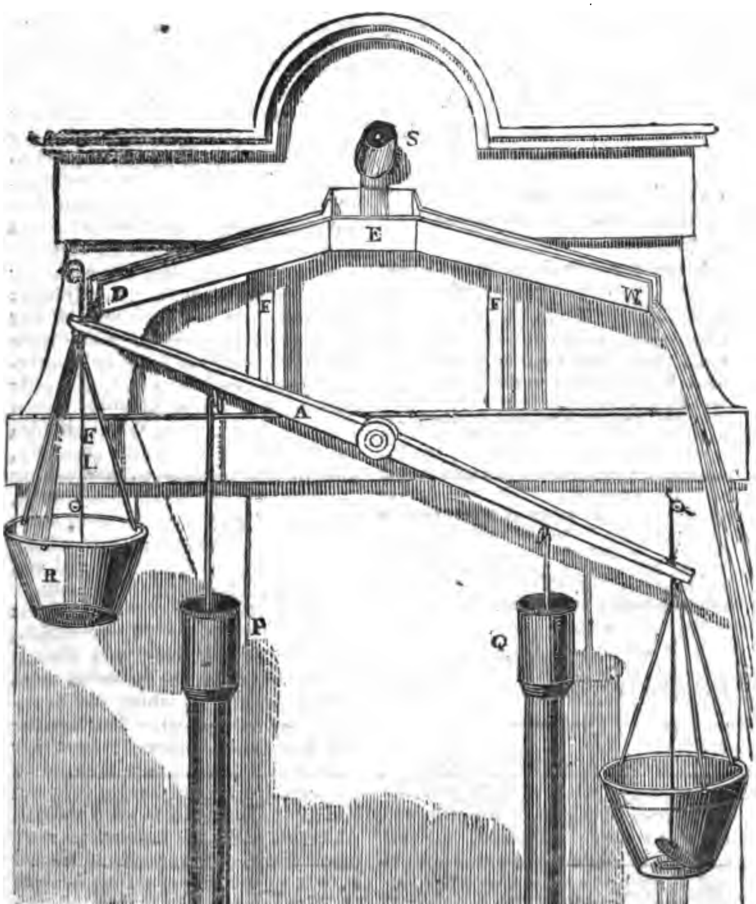
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 123.] SATURDAY, DECEMBER 31, 1825. [Price 3d.

"Who is he that hath acquired wealth, that hath risen to power, that hath clothed himself with honour, that is spoken of in the city with praise, and that standeth before the King in Council? Even he that hath shut out idleness from his house, and hath said unto sloth—thou art mine enemy."—*Dodsley's Economy of Human Life.*

PERPETUAL PUMP AT USEIN HAM, NEAR ASHBORN.



PERPETUAL PUMP FOR VIATOR.

S is a stream of water.

A, a lever.

FF are perpendicular posts supporting two channels, ED, EW.

Water runs down the channel, ED, and brings down the basin, R, at the bottom of which is a valve, P, which is opened by a rod, G, the button of which catching on a nail, at I, prevents it from descending too far; thus the water in R is suffered to escape, when the basin reaches the lowest point, and the same thing takes place with regard to the other basin; thus a perpetual motion is produced, and two pumps, P and Q, are worked. The above has been in use at Ham, near Ashborn, for forty years.

I am, Sir,

Your obedient servant,

F. O. M.

CRANE'S APPARATUS FOR SAVING THE LIVES OF SHIPWRECKED SEAMEN.

Sir,—In a late Number, a Correspondent expresses surprise where Mr. Crane obtained the drawing and description of the apparatus for saving the lives of shipwrecked seamen. If he will turn to the Evangelical Magazine, for October, 1820, he will there find a drawing, plan, and description, *verbatim* the same as appeared in the Mechanics' Magazine, and from which your account appears to be taken. I forget the name of the inventor, but it is sufficient when I state that, the same year (1820), the Society of Arts rewarded him with a silver medal for the invention, and the value of which he gave to one of the Missionary Societies, which, perhaps, may account for the invention being only noticed by one of the religious Magazines.

I remain, Sir,

Your obedient servant,

December 14th, 1825. I. E.

NAVAL ARCHITECTURE.

Sir,—The trials of sailing of the three vessels that have recently excited so much attention, without having yet attained the much desired end, fully prove what Colonel Beaufoy observes in the 111th Number of your Magazine, that "one great point has been gained by building the vessels, in showing that the synthetical process is inadequate to obtain the end in view." The following facts will still tend more strongly to confirm the Colonel's just remarks:—

As an old Lieutenant, of thirty years standing, I have seen many cases similar to the following, but these were the two most conspicuous. I was serving in two of his Majesty's ships, and an eye-witness. The Topaze (formerly French) frigate, on going first to the American station, sailed in a most astonishing way, eclipsing every vessel she ever sailed with, and this she continued to do for eighteen months. On a wind her advantage of sailing was at times eclipsed when the wind was strong and sea rough, which I attribute to her draught of water, being less than frigates generally are of her class. She was at length obliged to undergo some repairs, but no alteration of beams or timbers; was thoroughly cleaned, and her hold swept and her copper thoroughly cleaned. Previous to this, and when in her high renown for sailing, her draught of water, fore and aft, stay of her masts, and stowage of hold, were taken minutely, and the only alteration made, on her again being ready for sea, was layers of birch broom between her ballast, from an idea (not unjust) of giving an elasticity, and thereby adding to her sailing qualities. After being thus altered, she proved a worse sailer than ships she had on all occasions before astonishingly eclipsed, and she did not again regain her former celebrity.

Again, on going out to the West Indies in the Hector, 74, our station, in sailing in two lines, was abreast of the Orion, 74, the fastest of seven sail of the line of which our squadron was composed. During the day the Orion generally kept her station with her topsails lowered on the cap, the Hector having fore-sail and top-gallant sails to keep abreast. At night, when the hammocks were piped down, and one watch turned in, our superiority of sailing became so conspicuous over that of the

Orion, that it excited general attention, and the Hector always at night carried less sail than the Orion, as we were obliged to diminish and the Orion to increase sail to keep our stations abreast. Doubtless many officers in his Majesty's navy have experienced these wonderful changes in the same bodies without being able, in all cases, to assign or discover the real cause. In the Topaze it cannot be accounted for, unless it may have been the rigging, or some part of it, being more set up than heretofore. In the Hector, doubtless, it was the weight and swing of the hammocks, when suspended, instead of their dead top-weight in the nettings, and the irregular movement of the men on deck. But why should this not have an influence in one vessel as well as another remains to be solved.

Your insertion of this in your useful and instructive Magazine will oblige, Sir, your humble servant,

G. M. H——N, R. N.

London, November 25, 1825.

OF RAZORS.

SIR,—Your Correspondent 'Samoht,' on the question "Why does a razor cut better after being dipped in hot water?" concludes with a supposition which amounts to a practical fact. I have been in the habit of putting my razor into the fire immediately before use, taking care not to let it touch the coal, and I am able to affirm that a razor does cut better from this dry heat than that obtained from hot water. The idea that the water clears the teeth of the razor appears to me to be more fanciful than correct; but why may not the following lead to the true solution of the question:—Does not heated iron or steel adhere more tenaciously to our skin than either of the same metals when cold? If Mr. Pasley should be sceptical on this point, or should still think that fire does not communicate heat, let him take hold of a bar of heated iron or steel, and he will find it a difficult matter to re-open his hand. Heat expands these metals, cold contracts them. May not the cold air contracting, or cooling down the razor to its former state, cause it to adhere more closely to the face, by drawing nearer the pores of the iron or steel, which, in going over the chin, may possibly be filled with parts of the skin? I do not pretend to say that this is the reason; I ask for information.

As the original question may have been put for the purpose of obtaining a good method to get rid of the teeth or obstruction on the edge of the razor, it may not be amiss to state, that if your Correspondent "Novaculus," after using the hone and the strap, will draw the razor lightly over his thumb-nail twice or thrice, and afterwards as many times over the strap, he will find the instrument to be nearly clear from the interstices alluded to.

I am, Sir,
Your obedient servant,

December 5th, 1825. W. B.

NEW SALT MANUFACTORY.

(From the Liverpool Mercury.)

In the manufacture of Salt for exportation at Liverpool, which manufacture is principally carried on near the centre of Cheshire, two very costly inconveniences are experienced. The fuel has to be conveyed, by canal, from the collieries around St. Helen's, at a charge of about five shillings per ton; and the salt, after being prepared at the works, has to be conveyed to Liverpool, at the expense of three shillings per ton for freight, and one shilling per ton for river dues on the Weaver. These charges, calculating that half a ton of coal is used in the manufacture of each ton of salt, amount to six shillings and sixpence per ton upon the article when at Liverpool, over and above the actual cost of the materials themselves, the workmanship, and the profits of the salt proprietors.

To avoid these expenses, or the greater part of them, and thereby to reduce the price of salt for export, is the object of a plan now brought forward by our distinguished and energetic Mr. Cropper; and when the beneficial effects of the reduction in price which has recently taken place in consequence of the destruction of a mischievous monopoly, are duly considered, the advantages of still greater reduction in the price of this important article of commerce

will be too evident to require pointing out.

Mr. Cropper's plan is to establish salt works on the Lancashire side of the Mersey, a few miles from Runcorn, so as to be within a short distance of the St. Helen's and other collieries, from which coals may be cheaply conveyed upon rail-roads or otherwise; while from the works themselves (to be supplied with brine in the manner hereafter stated) the manufactured salt might be carried to Liverpool at a very trifling cost indeed.

The principal, and indeed a novel feature of Mr. Cropper's project, relates to the conveyance of the brine from its original subterranean pits in Cheshire to the proposed works; and this he suggests may be done by means of an iron pipe underground, extending from the former to the latter place, and passing of course beneath the shallow part of the Mersey near Runcorn. At first this appears somewhat startling, but it must be considered that distance alone presents no impediment to the flowing of water.*

We have, in Liverpool, two Water Companies, each of whom have pipes laid in our streets to the extent of more than thirty miles; and from surveys already made relative to Mr. Cropper's plan, it appears that a constant flow of brine from the pits to the works may be secured at the rate of 1,600,000 tons per annum, through a pipe of twelve inches diameter, having a fall of six feet four inches to a mile, the brine moving at the rate of one mile per hour. From this quantity of brine, which would be conveyed at an expense of about one penny per ton per eight miles, 400,000 tons of salt would be produced. The cost of the execution of this plan, so far as it relates to the main pipe and the engines for pumping up the brine from the deep reservoir at the works, when ready for use, is estimated at 65,000*l.*; and it is computed that the saving upon the quantity of salt exported from Liverpool, would be from 60,000*l.* to 80,000*l.* annually. In this estimate the erection of the works themselves is, of course, not included, as the expense of new works would be much the same in any suitable situation.

* We understand that, in Germany, salt brine has for some time been thus conveyed for many miles; a fact of which Mr. Cropper was not informed until long after he had conceived the idea here stated, and had mentioned it to his friends. The fact, however, proves the entire practicability of the plan.

CASE IN TRIGONOMETRY.

Sir,—In Emerson's Trigonometry, second edition, Prop. x. he asserts that the secant of an arch is equal to the sum of the tangent of it and the tangent of half its complement: this he demonstrates thus:—

Let A = arch, T its tangent, s its secant. $a = \frac{1}{2}$ complement, t its tangent; then, by schol. Prop. II. $s = \frac{rr + tt}{2t}$, and $T = \frac{rr - tt}{2t}$, and $s - T = t$; whence secant of A = tangent A + tang. $\frac{1}{2}$ complement of A.

Now, I shall feel particularly obliged to any of your mathematical readers for elucidating the above demonstration, so that a person of a small smattering in analytical trigonometry may perfectly comprehend it. Emerson was a man of profound knowledge in mathematics, and equal to any task, and, no doubt, the above appeared to his great mind as quite easy and simple, which to a novice is incomprehensible.

I remain, Sir,

Your obedient servant,

And constant subscriber,

Felix Ford.

December 9th, 1825.

CEMENTING AMBER.

Two pieces of amber may be cemented together by wetting with a solution of caustic potass, and pressing the parts together with the assistance of heat.—*Fourcroy.*

OF THE ANTI-NEWTONIAN PHILOSOPHY—SIR RICHARD PHILLIPS, MR. PASLEY, ETC.

Sir,—I avail myself of your invitation, (No. 109, p. 398,) to discuss some of the doctrines of the pretended new philosophy, to which Mr. Pasley seems to be a convert. Sir R. Phillips is the principal advocate of this strange medley of opinions, which instead of being new, are, in fact, such as were prevalent when philosophy was in its infancy.

If I understand Sir R. P. aright, (which is no easy task), he believes that universal space is absolutely filled by atoms, (for the most part globular in form), in actual contact with each other, and of course that all motion is caused by the collision, or pushing of particles of matter against such as are contiguous. Hence he ridicules the Newtonian doctrines, (in which the particles of matter are not supposed to be in contact), and asserts that "every phenomenon of attraction, repulsion, and caloric, may be explained and illustrated on strict mechanical principles, and that they are in every case mere mechanical affections, resulting from causes easily understood." He adds, that "the fall of bodies to the earth is the effect of their own motions," &c. Now, in opposition to this "*Common Sense*" philosophy, I scruple not to affirm that *none* of the phenomena above mentioned can be explained on strict mechanical principles. That the particles of matter are *hard* and *impenetrable*, is an assumption which has been plausibly controverted by Boscovitch and Priestley; but if they are *impenetrable*, what do we understand by that term except that they exercise a *resistance*, or *repulsion* which we cannot overcome? But to waive this point, and suppose an absolute *plenum* in the universe, it is obvious that *cubes*, and a few other regular bodies, are all that can join so as to leave no vacuities; and it is equally obvious that in such a case every kind of motion must be altogether impossible. Motion by contact can, therefore, only take place in such an imperfect *plenum* as can be made by globular bodies of various sizes, and which may be compared to a collection of bomb-shells, cannon balls, musket bullets, small shot, grains of sand, &c. the smallest kinds of which may be supposed to represent the *gases, light, heat, electricity*, &c. The effects of the movement of one particle on the rest, in such an universe as this, may be put to the test of experiment by means of a quantity of marbles, intermixed with shot, sand, &c. when such as are not wilfully blind, will see at once, that no motion, in straight lines, like the rays of light, can possibly be propagated in such a mixture of atoms. Yet Sir R. P., with matchless absurdity, supposes the rays of light to be almost "like a solid rod," or line of particles in contact; and the absurdity becomes almost infinitely increased, by supposing such trains of particles to *converge* to, or *diverge* from innumerable points in the universe, to form the efficient powers, which we call *attraction* and *repulsion*, the force of which is known to vary inversely, as the squares of the distance from the attracting or repulsing particle. But Sir R. P. says again, "the motion of a central mass, like the sun, in the gas of space, produces motions, or *vortices* of that medium, competent to carry round the planets in orbits, and turn them on their axes."

Here, again, experiment will prove that none of these *vortices* can take place in a system where the particles are in contact; or if any where, it must be in the brains of Cartesian philosophers. Besides, this theory, if true, does nothing towards giving a mechanical reason for the motion of the sun on its axis; which, it may be presumed, can no more move of itself than any other planet. "Gas, (says Sir R. P.) is matter in motion," and I believe he means in circles, as well as on their axes; yet every one knows that particles cease to revolve whenever they come in contact with any solid substance, and, of course, such motions cannot take place in a red hot iron bar, &c. which is the means by which this strange philosophy accounts for *heat, light, &c.*

It is true, if you allow a sufficient primary force to turn one globular

particle, others might be turned in opposite directions by contact with each other; but any *three* particles in *mutual* contact, would *resist* each other's motion. It ought also not to be forgotten, that particles in motion meeting each other, destroy each other's force, and the motion of both is lost; which shows, (contrary to Sir R. P.'s principles), that were there no other moving power than *matter*, all the motions in the universe would quickly cease.

The contraction, or bursting asunder of bodies, Mr. Pasley, (like Sir R. P.) attributes to *external* or *internal* pressure; but according to the *plenum* system, there is no source whatever whence either external or internal pressure can be derived. In short, Mr. Editor, I hope you will see that these doctrines, advanced as they have been, on the credit of naked assertion only, have no tendency except to bewilder and stultify your unlearned readers.

Thus your correspondent, D. Y. (No. 80. p. 380,) says; "attraction is a name for nothing; for as matter is absolutely inert, to be so, and have the power of attracting at the same time is utterly impossible." This, Sir, is something like saying that the universe of matter is nothing; for what other knowledge of matter have we than that it attracts or repels, moves or is at rest? Mr. Pasley says fire makes no addition to bodies with which it combines, yet I presume he will allow that metals are *enlarged* by it; a consequence which can only follow, if, on his principles, the particles remain in contact, by the enlargement of the original atoms; a strange sequence indeed.

But Mr. Pasley will not believe that an iron bar which is held in the fire till it dazzles our weak optics is *hot*, because, forsooth, the iron *feels* no heat. Indeed he seems far gone in the mysticism of Bishop Berkley, who had "every virtue under heaven" except common sense.

Berkley's wisdom flows in this kind of sophisms, viz.: "The table exists, *i. e.* I *perceive* it," &c. though every one knows that a table *exists* as much in the dark as if ten thousand people saw it at once.

"The prismatic spectrum, (says Mr. P.) is not in the screen, but in the mind." Why not in both? Cannot we trace the rays of light from a person leading us to a mirror, and back again into our eyes? If light is only in the *mind*, what use is an optical apparatus to turn the rays in various directions, where they may be traced with mathematical certainty? But indeed all the science of the world is of no avail with these minute and paradoxical philosophers, who in the days of Berkley discovered that the universe is, or exists, solely *in our minds*, instead of our being *in the universe*. The world is here completely turned inside outward, and every natural idea is turned topsy-turvy, as if the brain were already on the whirl in Cartesian vortices.

I hope these few hasty remarks may induce your readers to turn away at once from these Anti-Newtonians; for being partly Materialists, and partly Idealists, they will scarcely leave them any traces of either body or spirit, if they once consent to forsake the golden rule of common sense; which, in my opinion, is that sense which results from a proper use of the other five.

T. B.

ENGLISH GRAMMAR.

Sir,—The pleasure I have received from the perusal of your highly, and deservedly esteemed Magazine, has only been surpassed by that I have experienced in reflecting upon its utility to society in general.

Practical science is, in no small degree, indebted to your labours, and your countrymen will long have occasion to think upon your undertaking with gratitude. But, amongst the numerous subjects which have occupied your pages, I do not remember having met with any article upon English Grammar.

If language be a key to the other sciences, its cultivation is surely worth our attention; and, under this impression, I am induced to suppose that this, and future communications upon that study, may not be deemed unacceptable.

I shall, in this paper, make a few observations upon the state of grammatical knowledge in this country; and, if my intentions meet your approbation, will begin, in my next, to point out a brief method, by means of which a competent knowledge of this ornamental and useful branch of learning may be acquired in a short time, without a tiresome application to theoretical treatises.

Of the usefulness of grammar in general, and particularly that of our own language, it is unnecessary to make a single observation; because no reasonable person will deny that what we have daily and hourly occasion to do should be done well. Must it not then be matter of surprise that so few of our countrymen are acquainted with the elements of their native tongue?

Amongst the higher classes, it has been notoriously neglected, and classical grammars have been employed in its stead; but *these*, as every day's experience proves, bear little affinity to *our language*, and afford the student few rules calculated to assist him in its construction. I do not deny that a comparison of the structure of these languages with our own will tend materially to our improvement; but I strenuously contend, that an acquaintance with the latter is not to be formed by means of the former only, any more than a knowledge of the Ionic order can be acquired from the study of rules applicable to the Corinthian.

Well may our continental neighbours laugh at the ridiculous pride of the Englishman, who thinks himself of too much consideration to study his own language, and who resembles the jackdaw in the fable, that dressed himself in the plumes of the peacock, which were mighty fine in his own eyes, certainly, but not of half so much value to him as his natural feathers.

Is it possible that the clergyman, who has been purposely educated to teach us, is in danger of saying diametrically opposite to what he intends? Every man is in danger of doing so who is unacquainted with the rules that should govern him in the exercise of the language in which he speaks.

Can it be believed that the barrister, who professes to explain the meaning of the laws that have been enacted for our government, undertakes to do this without a knowledge of the language in which they are written? Alas! in nine instances out of ten this is the case.

O for a commission to inspect the packets of letters deposited at the general post office, that we might see at once the state of grammatical knowledge in this kingdom! O for a day's perusal of the epistles of military officers, country gentlemen, physicians, and merchants! Then might we form a just estimate of the utility of the dead languages in teaching us our own. Then should we be convinced of the ignorance and idleness of those, who would attempt to persuade us that an Englishman misapplies his time in learning to speak so as to be understood.

It cannot be matter of much surprise, when we see the higher orders of society so deficient in this matter, if we find a want of information subsisting amongst the middle classes. But the happy period has arrived when they have begun to think for themselves, when they have discovered that the useful sciences properly belong to *them;* and when, unless a little more industry be evinced by their superiors, they will make them exclusively their own.

Many intelligent persons amongst the trading community have not, indeed, thought it beneath them to learn to speak and to write; but a far greater proportion, from the force of example, and the stupidity of their teachers, in adopting methods which have given them a disgust for grammatical studies, and impressed upon their minds an idea that acquisitions of this kind are attended with labour and difficulty, or from other untoward circumstances, remain yet unacquainted with the rudiments of their native tongue.

The lower classes, of course, are still ignorant of rules to direct them in their conversation; but, in an age when education has so universally extended itself, it would perhaps be

going too far to say how long this may be the case.

Leaving the great luminaries of the land, and their satellites, to the quiet enjoyments of their Latinized English, and the propriety of educating the lower orders to the consideration of others, I can see no reason, Mr. Editor, why the middle classes should neglect to inform themselves upon this necessary accomplishment, especially as there is so little difficulty, and so considerable an advantage to be derived from its acquisition.

With the best wishes for your prosperity, and that of your undertaking,

I am, Sir,

Your obedient servant,

W. SMITH.

Castle-House Academy, Guildford.

QUESTIONS IN SHAVING.

SIR,—The letter of your Correspondent T. H. Pasley, in answer to the question "why a razor cuts better after it has been dipped in hot water?" presents one of the most curious pieces of unintelligibility I ever met with; and fully warrants the conclusion you have drawn, that some of its inferences are at least illogical. The assertions that a razor has abstractions in itself to overcome; that there is no such thing in nature as a hot body, and that fire cannot but act similarly on all bodies, are absurdities too palpable in their nature to require comment. The last sentence of his letter would lead to the supposition that it was necessary, in order to make a razor in a fit state to shave well, that its edge should, by the abstraction from between its teeth of electric matter, (which he most absurdly compares to grains of sand or saw-dust sticking there), be rendered a complete saw. How vain, then, and ill-applied have been the efforts of all our tonsors, &c. from the earliest ages to the present moment; directed as they have invariably been, to the production of a smooth edge to their tools.

I am not by any means satisfied with the explanation offered by *Ignis*. He says that the heat of the water, causing expansion of the metal, tends to *equalise the edge*. Expansion certainly does take place; but its effect upon the edge of the razor, if worth taking into consideration at all, is just the contrary to that asserted by Ignis; for in order to produce a level edge, heat must, while it caused the gaps to disappear and fill up, at the same time contract the teeth, or at least not lengthen them; otherwise, (what in fact is really the case), that portion of metal forming the teeth, being increased in bulk, as well as that which forms the gaps, the edge remains the same as before; perhaps we might say that the inequality of the edge is rather *increased*, because the teeth containing in them a larger proportion of metal than the vacancies, their expansion must also be proportionably greater.

Samoht asserts, that the strap and hot water do no more than clean out the interstices. This, I think, is not quite correct; inasmuch as the substance with which straps are in general covered, (*Emery*, mixed with tallow), renders this operation upon the razor very similar to that of the hone. I have, for a very considerable time past, made use of such a strap, and have never had occasion to resort to a hone.

The inquiry of T. M. B. should be first set at rest: "Whether a razor does really cut better after immersion in hot water than before?" I have very many doubts of this. Since the question has appeared in your pages, I have tried the experiment of shaving without dipping the razor in any water, either hot or cold, and I have not found any perceptible difference. I have also made inquiry of some of my friends who never use hot water, and they inform me that they shave without any difficulty; that their razors do not require a more frequent use of the hone, than is the case with others; and that they even prefer the cold water to the hot; this last circumstance may probably arise from habit.

Under the supposition that the inquiry is founded in truth, might not the contact of a cold razor have the effect of chilling the skin, and producing a slight degree of that in-

equality which is known by the name of "goose skin," or "cutis anserina"? or might it not render the hairs of the beard more rigid and stiff? Yet the rapidity with which a razor is passed over the face, would scarcely allow time for this to take place.

I remain, Sir,
Yours very obediently,
HEROS.

Spaldwick, near Kimbolton.

ERROR IN FERGUSON'S MECHANICS.

SIR,—As familiar elucidation, and simplicity of phraseology, are the only means by which the unlettered Mechanic can acquire proficiency in the knowledge of his art—and as he is prevented from deriving any benefit from the majority of books which treat of Mechanical Philosophy, by reason of a calculus which he cannot investigate; and propositions by which he cannot profit, owing to the laconic abstruseness of expression in which they are presented to his understanding; it is much to be regretted that any inaccuracies should occur to mislead or perplex him, in the few books that contain the only available sources of his information.

These considerations have induced me to offer for insertion, in your highly valuable and extensively circulated Miscellany, a few remarks on an error, which a slight inspection will render obvious, in Ferguson's Mechanics.

In vol. 1, plate 3, fig. 1, Brewster's edition, after having by means of the lever, the screw, and the wheel and axle, raised his power to 600, he introduces four pulleys, two fixed, and two moveable ones, with one extremity of the rope coiled about the axle; the other made fast to the block containing the rising pulleys; and this he calls (page 56 of the same vol.) a fourfold power. Now, Sir, I contend that this is not merely a fourfold power; it is to all intents and purposes a fivefold power; and instead of a power of one ounce, applied at the end of the lever, being sufficient to balance, in this complicated machine, a weight of 2400 oz.; it is in fact sufficient to balance a weight of 3000 oz. suspended from the rising pulleys. For according to Emerson, when pulleys are made use of in this manner "The power is to the weight, as 1 to the number of parts of the rope acting against the moveable block." Now by altering the disposition of the terms, without destroying their relation to each other, we may have them placed thus:—As 1 is to the number of divisions of the rope acting against the moveable block, so is the power to the weight; which, when resolved into definite terms, will, in the present case stand thus, as 1 : 5 :: 600 : 3000.

That Ferguson's description of this part of the figure, is completely false, may be proved by a variety of methods. The error indeed is so obviously manifest, that in taking the liberty of drawing the attention of your numerous readers to the subject, I feel a suspicion, that I am doing that which is in a great measure unnecessary, as all who have taken any trouble to examine it, must be aware that it is one. Yet Enfield, I observe, has copied into his Cyclopædia, this very figure, together with its corresponding explanation, in a manner that might have reflected on him the greatest credit had *fidelity of imitation* been a sufficient excuse for increasing the publicity of erroneous examples.

I am, Sir,
Your most obedient servant,
W—.

Mechanical Institution, Morpeth.

COPPER.

This is a metal of the specific gravity of about 8.690, and when pure has a peculiar shining reddish appearance familiar to almost every one. It is of a very hard nature, sonorous, elastic and ductile, having a very disagreeable nauseous taste, and when heated emitting an unpleasant smell. Possessed of great malleability it may be beaten into extremely thin leaves, or drawn into a most subtile wire. Its tenacity is such as to enable a wire one-tenth of

an inch in diameter to support a weight of 299lbs. without breaking. Copper is found in great abundance in various parts of the globe: in England it is very plentiful, particularly in the Isle of Anglesea and Cornwall. In China, Japan, Siberia, South America and elsewhere mines of this metal have been worked. The common ore met with in this country under the name of *pyrites* is a *sulphuret* of copper. There are also two varieties of the mineral under consideration known by the names of *Mountain-green* and *Malachite*, which are *carbonates*. Native *oxides* also, and a *sulphate* of copper are met with in some parts of South America, and sometimes in Cornwall. These different ores have a variety of appearance, some being of a bright gold colour and others having a dingy hue, according to their richness. There is one very beautiful sort known by the name of *Peacock copper*, which exhibits a display of several colours, supposed to be in appearance like the tail of the bird from which its name is taken. The method of detecting this metal is very simple, merely by dropping a little *nitric acid* upon a suspected portion of it, and then with a feather rubbing it upon the clean blade of a knife: should any copper be present it will be precipitated upon the blade and give it a coppery hue, proving also the stronger affinity of nitric acid for iron, to which it attaches itself and leaves its former combination. Another method may be tried by adding nitric acid to a little piece of it when broken and put into a glass, with the addition of a small quantity of water; afterwards drop a small proportion of spirits of hartshorn into the glass and a beautiful *blue precipitate* will be the result. It may be known also by urging the flame of a blow pipe upon it when laid upon a piece of charcoal in contact with a small portion of borax, when it will readily melt into a globule of pure copper. Copper is not so readily combustible as iron, and will not emit sparks when struck with a flint. This metal is capable of uniting with oxygen in two proportions, forming the *red* and the *black oxides*. The red contains the smallest quantity of oxygen, and is called the protoxide; while the black or peroxide contains double the quantity, there being in 125 parts of the latter 25 of oxygen. Exposure to damp air will readily rust copper, and the appearance of this rust called *verdegris* is well known: it is an *acetate* of this mineral. It has been remarked that this coating of rust extends only upon the surface, and does not penetrate into the substance of the mass; and many antique images and medals have been dug up, after having lain for a considerable number of years in the earth, and, upon cleaning their exterior, the whole has been found in a high state of preservation. Cold water or any other cold fluid will more readily form verdegris than hot liquors, and on that account copper vessels may be used with impunity, provided the precaution be taken of allowing nothing to grow cold in them.

To enumerate all the purposes to which this metal is and may be applied would occupy more space than is here necessary. Boilers, coppers, and sundry other kitchen utensils are commonly manufactured of it. The well known composition *brass* is a mixture of it with carbonate of zinc. *Princes' metal*, or *pinchbeck*, is an addition of metallic zinc to brass or copper. *Brunswick-green*, *Scheele's-green*, *blue verditer*, and some other green colours used in painting, are salts of this metal. *Gun metal* and *bronze* are composed of copper with the addition of tin, and which addition preserves the composition from readily tarnishing. With a larger proportion of tin it forms *bell-metal*, and sometimes other mineral substances are added to improve the sound. In the healing art copper is occasionally employed in small doses; it requiring to be administered with great caution, and always by the direction of the medical practitioner: never should it be given as a domestic remedy, for from a very small over-dose *death* will most probably ensue.

T. G.

Islington.

EXTINCTION OF THE SUN.

SIR,—It is usual on reading any new subject connected with mathematics, to render the principles more familiar to the mind, and to exercise the ingenuity by attempting the solution of problems, which certainly sharpens the invention and impresses the information gained more forcibly on the recollection; now, on reading the principles of Dynamics, what question is more likely to occur on arriving at the problem of the three bodies, than how the removal of one would affect the motion of the other two, and this is the question before us. If we put the problem in general terms, instead of specifying the earth, sun, and moon as the three bodies, of which the sun is to be supposed extinguished and annihilated, it is at once divested of its presumptuous features, and appears what it really is, an interesting and elegant dynamical question. I do not quite agree with T. J., that we are to make any allowance for unforeseen contingencies depending on this very improbable event; if that were the case, we should indeed be without data, but as it is, we are at liberty to suppose that the only effect consequent on the extinction of the sun, would be that which would be produced by the amotion of its force. It is perfectly true that there would be no light but that which is emitted by the fixed stars, but nevertheless the moon would still be able to find her way, and, like a faithful servant, would still perform her duty, as far as it would remain in her power, and would still attend upon her mistress in her unprofitable rambles through infinity.

I remain, Sir,

Yours respectfully,

F. O. M.

Nottingham, Dec. 10, 1825.

VAUGHAN'S STEAM ENGINE.

SIR,—I have lately heard a great deal said of the merit of a new patent engine made by Vaughan, of Sheffield, of the coal it saved, the work it did, and the wonders it performed in various ways. I was, in consequence, anxious to see one of these machines, and have lately been gratified; but as I can see no reason why it should do more work with the same coal than Bolton and Watt's engine, I beg an explanation from some of your readers; to which end I will describe the parts in which it differs from the last mentioned engine.

The cylinder is made and worked open both at top and bottom, with a solid partition in the middle; both the upper and lower part of the cylinder has a piston fitted to it, on the rod of which is fixed a cross head; there is likewise a rod on each side the cylinder, connecting the two cross heads, so that both pistons move together, and it will be readily understood that when one piston is nearest the partition in the cylinder, the other is farthest from it. The steam is admitted alternately above and below this partition, and while the communication between the boiler and one side of the partition is open, the part of the cylinder on the other side of the partition is open to the condenser. Now let us examine the action of this engine, and compare it with those made by Bolton and Watt.

Suppose the engine at work—that there is a perfect vacuum in the condenser—that the pressure of the atmosphere is equal to 15lbs. on every square inch, and that the steam is worked 5lbs. above this, or 20lbs. on the square inch; suppose the pistons to be each nearly 20 inches diameter, and to be moving upwards; the area of each piston will equal 314 square inches. The passage from the boiler to the under side of the upper piston being open, there is a pressure of steam equal to 20lbs. on every square inch, pressing it upwards, but this is opposed by the atmosphere, which is equal to 15lbs. on every square inch, the difference is 5, therefore the power of this piston is equal to $314 \times 5 = 1570$lb. At the same time there is a perfect vacuum between the partition in the cylinder and the upper side of the lower piston; the pressure of the

atmosphere tending to raise this piston will therefore equal 15lbs. on every square inch=314 x 15=4710lbs., which added to 1570, the effective pressure on the other piston, gives 6280lbs. pressure for the combined power of the two pistons. Now an engine on the plan of Bolton and Watt, under the same circumstances, will have a perfect vacuum on one side of the piston, and the whole pressure of the steam on the other, which is equal to 314 x 20 =6280lbs. pressure on the one piston, which is equal to the pressure on the two pistons of Vaughan's engine. It therefore appears to me, that instead of Watt's engine being the *inferior* of the two, it is the *superior*, inasmuch as Vaughan's is more complicated in its construction, has the friction of two pistons instead of one to overcome, and the cylinder being chilled at every stroke by the admission of the cold atmosphere, the steam is thereby uselessly condensed, or wasted: not to mention the extra expense of packing and tallow. But if it is really equal, or superior to Bolton and Watt's, I shall be very happy to learn *why*, and *in what it is so*.

Yours respectfully,

S. Y. (a young Engineer.)

ON THE ELASTICITY OF AQUEOUS VAPOURS.

It is most certain that the elasticity of vapours, and that of air, depend upon the same elements; upon density and temperature. Hence, it would appear, that, both in the case of air and in that of vapours, we ought to divide these two elements, and to investigate separately the effects of each, by making the density vary whilst the temperature remains constant, and *vice versa*. But we are freed from this trouble by a singular property of vapours, not long since discovered, and fully ascertained by the most accurate experiments: namely, that their density necessarily depends on their temperature; so that to every degree of temperature belongs a certain and determinate degree of density, which remains constant, whilst the space through which the vapour is diffused is diminished or increased; and this happens because, whilst the space occupied is diminished, a part of the vapour is condensed and turned into water, and whilst the space occupied is dilated, the subjacent water disengages a fresh supply of vapour, whence, upon the whole, the density suffers no change.

This constant density, however, of vapour only obtains where there is a quantity of water sufficient to furnish so much vapour as will fill the whole capacity of the space through which the vapour is diffused, and will maintain it at the assigned degree of density. Otherwise the density will necessarily decrease, and will go on decreasing more and more, the more the capacity of the recipient is enlarged: and on the contrary, if this capacity be diminished, the density will go on increasing until it reach the assigned degree, at which it will remain constant, however the space be afterward diminished.

Where vapour is employed as a mechanical agent, there is always a reservoir of water capable of revolving new vapour sufficient to keep the recipient space full. Wherefore we may safely suppose vapour to have that degree of density which belongs to its temperature, and we may investigate how much its elastic force increases whilst its temperature increases.

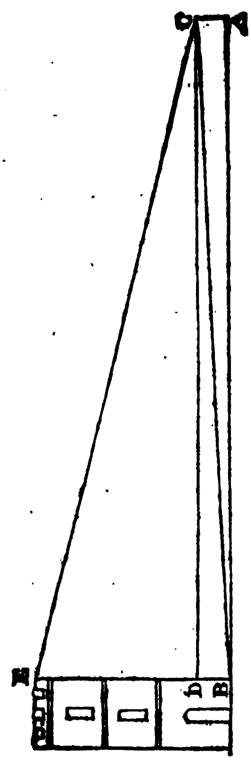
Experiment.—This investigation has been made with singular accuracy by Dalton. His apparatus consisted of a simple barometer tube, of which the inner surface was wetted before the introduction of the mercury. The mercury, well freed from air, having been afterwards poured in, according to the usual manner, the tube having been inverted, and its mouth having been immersed in a vessel full of mercury, the moisture introduced into the tube was collected in the vacuum at the top, and a thin layer of water stood on the surface of the quicksilver. The temperature was then increased gradually by pouring water more and more heated into a gun barrel which

surrounded the whole of the upper part of the tube; as the temperature increased the column of mercury sunk more and more. The height of this column having been subtracted from the height which represents the pressure of the atmosphere, that is, from the height of the mercury in the common barometer, there resulted the measure of the elasticity of the vapour.

F. O. M.

(To be continued.)

A METHOD TO DETERMINE THE DISTANCE AND ELEVATION OF A TOWER, ETC. FROM ONE STATION, STANDING ON A PLANE.



Adjust the instrument raised to a convenient height, say five feet; take the angle of depression, BCD, then, as the opposite sides and angles of parallelograms are equal, we have that and the side BD, or the angle ABC and side AC, to find AB or CD; thus, radius : cotang. B : : 5 : AB or CD = distance. Then take the vertical angle ECD, and radius : tang. C : : AB or CD : DE, to which the height of the instrument being added, we have the elevation.

There is nothing in this but the method of making the height of the instrument a side; only the determination of heights and distances is a subject on which thousands of intellects have been exercised, and it does not appear, as far as I know, to have previously occurred to any one.

I am, Sir,

Yours respectfully,

T. H. BELL.

Alnwick, November 20th, 1825.

INSTANTANEOUS LIGHT.

SIR,—In answer to the question of a Correspondent, p. 132, vol. IV. I hope the following will be found satisfactory.

Bottle.

Asbestos, sufficient to soak up sulphuric acid, that none may run out.

Matches.

10 grains of sulphur.

10 grains of oxymuriate of potash

Spirits of turpentine, sufficient to form a paste, coloured with vermilion or to fancy.

I remain, Sir,

Your most obedient servant,

N— B—.

INQUIRIES.

NO. 171.—GOLD PRINTING.

SIR,—Among the numerous benefits your work is conferring on mankind, I reckon as not the least valuable, the facilities it affords to inquiries into the processes of art and the investigations of science, of asking and obtaining information on

their various matters of pursuit. I believe the subjects thus propounded are often of general importance, and always of interest to many readers. Permit me now, if you please, to share in this advantage, by stating my question.

I wish to be informed of the process employed in imprinting Figures and Letters of Gold upon Paper. There have been some beautiful specimens of this art exhibited lately in London: I need only refer to one—the famed Speech of the Duke of York on the subject of Catholicism; upon the matter of which however much people may differ, there can be but one opinion on the beautiful manner in which it was printed for sale.

My desire in seeking this information is, to make the art subservient to the production of a celestial planisphere. My method is, to prepare a large sheet of card-board, by covering it with an uniform coloured ground; I prefer azure, as being the colour the sky presents, because I think it proper, even in this rule-bound division of the imitative arts, to preserve analogies as much as convenient. Upon this ground I propose to dimly shadow out, in the same colour, the forms of all the fabled machinery of the heavens, and to imprint in gold upon the drawing so prepared, all the stars that present themselves to the unassisted sight, in suitable figures, and in dimensions proportioned to their magnitudes. I would have the constellations bounded by no hard outlines, and the forms should be sufficiently made out by the shadowing. Neither would I draw any of the customary lines of the sphere, except the ecliptic, which should be faintly marked; all the others might be well dispensed with, because a ruler suitably graduated, with the assistance of a graduated circle to represent the equator, would determine with precision the place of any star in declination and right ascension. I think, a planisphere so constructed, if executed with tolerable skill, would not only be a thing of very elegant appearance, but, by reason of its being unembarrassed by extraneous lines, would afford the means of a more ready and off-hand perusal of the heavens, than any of the customary representations, in which the black outlines and shadows of the imaginary figures, the lines for determining the relative places on the plane, and those of the stars in the same colour, present such an indistinguishable chaos to unpractised eyes, that the uninitiated part of mankind, for whose use they are chiefly intended, generally cast them aside as things too deeply mysterious for their investigation.

I hope the information I ask is not among the reserved secrets of a craft, but that some of your intelligent and liberal readers will favour me with the account of the process.

I remain, Sir,

Your most obedient servant,

WILLIAM C——.

Reigate.

NO. 172.—BREWING.

SIR,—Will you be kind enough to give the following inquiry a place in your highly useful publication?—

Whether it would not be an improvement in brewing to prevent the loss of so much vapour which necessarily flies off in the usual mode adopted in boiling, by having the cover of the boiler fitted close, and a condenser attached to it to receive the steam and reduce it into a liquid state, and then mix the condensed liquor with the wort before you put it into the casks? Would not such a process produce a considerable saving in the quantity, as well as add greatly to the strength of the beer?

A friend of mine, instead of allowing the liquor to cool in the usual way, passes it through a sieve from the boiler into his casks, and finds the strength of his beer much increased by doing so, without injuring it in flavour or in any other way; he also finds it to keep much better. No doubt its increased strength arises from the before-mentioned cause, viz. a saving of vapour.

Perhaps some of your ingenious Correspondents may suggest a cheap,

simple, and convenient condensing apparatus for the above.

Any answers to the above will be thankfully received by,

Sir,

Your most obedient servant,

A Novice.

Old Broad-street.

ANSWERS TO INQUIRIES.

NO. 153.—EXTRACTING WAX FROM HONEYCOMBS.

Sir,—At page 382, vol. iv. of your Magazine, a Correspondent wishes to be informed of the most economical method of extracting wax from bee-combs. By inserting the following you will not only oblige him, but render an essential service to the community, as I am convinced one-third of that useful article is totally lost for want of this simple and effectual method of extracting it being generally known.

Have on the fire an open vessel of boiling water, and standing by the fire an open vessel of cold water; put the comb, close tied in a canvas bag, into the boiling water, and repeatedly squeeze it down with a stick, or large wooden spoon, the wax will come through the bag and swim on the surface of the water; skim it off, and put it in the vessel of cold water; by repeatedly squeezing the bag and skimming, every particle of wax will be obtained; when congealed on the cold water, it may be taken off, again melted, and cast into moulds of any convenient shape for sale.

James D. M.

Northchurch.

NO. 167.—ON BEES.

Sir,—Mr. Bragge, of Derby, had better spare his time and trouble in the endeavour to make the theoretical hive of Huish; the Lombard hive, and Howitson's Scotch hive, are far preferable. The sticks or pieces of wood at the top of Huish's hive are useless as girdles for the primary construction of the combs, for, nine times out of ten, the bees will choose to build their comb either direct or obliquely across them. I have lately made a hive in the Poland form, of deal wood, known at the carpenter's by the name of American pine; it is half an inch in thickness, rough as it comes from the saw, smoothed a little with the tooth-plane. It is six feet in height, six inches square, and divided into stories one foot high; on the outside of this is another frame of half-inch deal, forming a square of one foot, and the interstice between the two frames to be filled with straw, to protect the inner frame from heat in summer and cold in winter. The back part is made to open with a door from the top to the bottom: a pane of glass forms the back part of the inner square, and is covered by a black bag containing chaff: a hole of communication is made near the glass between each division, and each division has a separate entrance in front, three inches wide and one inch and half deep. At the top of each division are nailed angular pieces of wood, at one inch and a half distant, as a guide to the bees. The top of this hive is covered with tin, filled with straw. It stands on a large tub filled with sand, and faces the east.

Believe me, Sir,

Your most respectful well-wisher,

******.

NO. 101.—REFRACTING TELESCOPES.

Sir,—The prismatic rings of colours, which your Correspondent, in Inquiry 101, seems unable to account for, were, and perhaps are now, in some instances, an original defect in Refracting Telescopes, as they would only bear a small aperture, without exhibiting those colours which are subversive of their utility. Two causes contribute to this effect: first, spherical surfaces do not refract the rays of light accurately to a point; and secondly, the rays of compounded light being differently refrangible, come to their respective

foci at different distances from the glass, the more refrangible rays converging, of course, sooner than the less refrangible. Under these circumstances, to increase the length of refracting telescopes became the only means of obtaining great magnifying powers; and though the means of converging the rays of light to one point still remained an object of speculation, the attainment of it seemed, in the days of Newton, attended with insuperable difficulties. However great they were, they have been nearly overcome by the perseverance and signal merit of our countryman, John Dolland; his object-glass is composed of three distinct lenses, two of which are convex, the other concave. Telescopes with such an object-glass are known by the name of achromatic, signifying colourless. The concave lens is composed of flint-glass, the convex ones of London crown-glass. The concave glass is fixed between he other two, and they are all ground to spheres of different radii, according to the refractive powers of the different sorts of glass and the intended focal distance of the object-glass of the telescope. According to Boscovich, the focal distance for the parallel rays of the concave glass is one-half, and for the convex glass one-third of the combined focus.

It has been very generally said and believed, that Dolland made his original experiments and constructed those excellent three-feet glasses (which at present bear so high a price, and are not to be imitated) with one single parcel of glass, which accidentally proved superior to any that has since been produced. This appears a vulgar error, for though parcels of glass made to the same formula may differ a little, yet as good glass for optical uses may be obtained now as formerly, and consequently as good telescopes, if the same great skill and disregard of expense with which Dolland adapted the curvatures of his lenses to each other and to his glass, were again brought into action.

The impossibility of obtaining perfectly homogeneous glass, and the consequent failure of producing that complete correction of the aberration of the rays of light in the telescopes called achromatic, induced Dr. Robert Blair to try the effect of fluid medium, and his success was such as to excite him to give the term aplanatic, or "free from error," to those he constructed. He made a compound lens, consisting of a plano-convex lens of crown-glass, with its flat side towards the object, and a meniscus (a glass of similar shape to a watch-glass) of the same material, with its convex side in the same direction, and its flatter concave next the eye, and the interval between these lenses he filled up with a solution of antimony in a certain portion of muriatic acid. The lens thus constructed did not exhibit the slightest vestige of any extraneous colour; still the invention, after a lapse of more than thirty years, has not come into general use, probably from the difficulty of preserving any fluid from growing turbid in the course of time.

I should much like to see Inquiry 74, page 80, vol. III. answered, as likewise Inquiry 144; but opticians seem reluctant to answer questions in their art, perhaps from self-interested motives.

I am, Sir,

Your most obedient servant,

P— P—.

Chepstow.

Notices to numerous Correspondents will appear in the next Number.

*** *Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

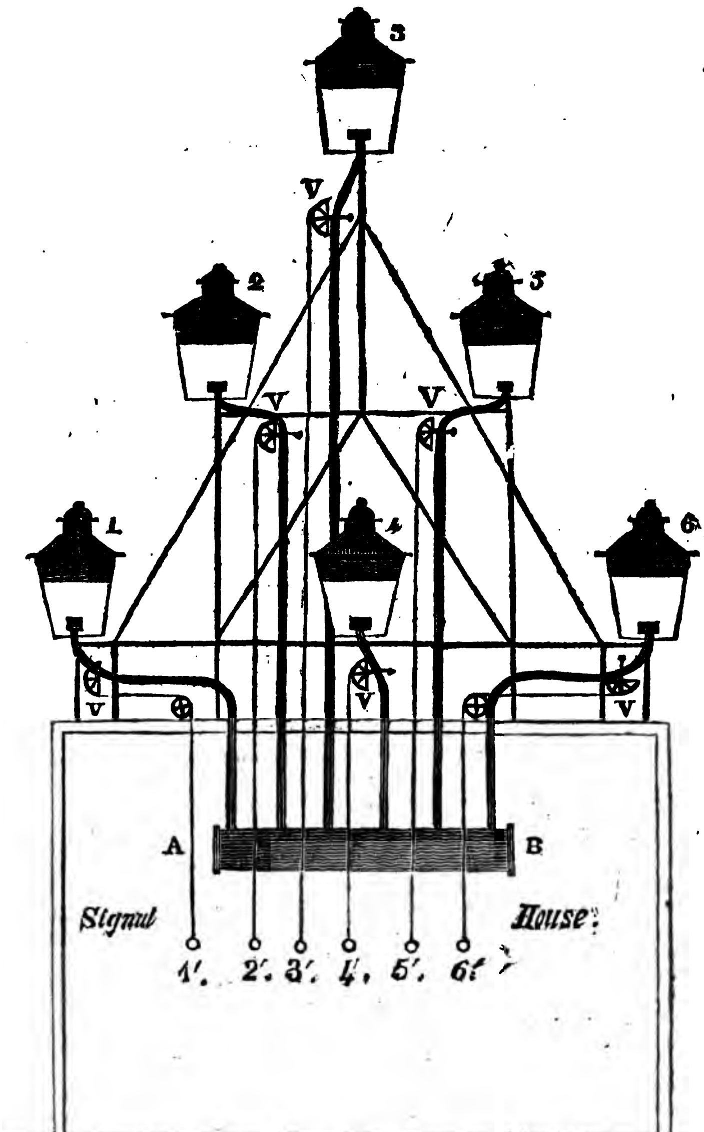
Printed by *Mills, Jowett,* and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

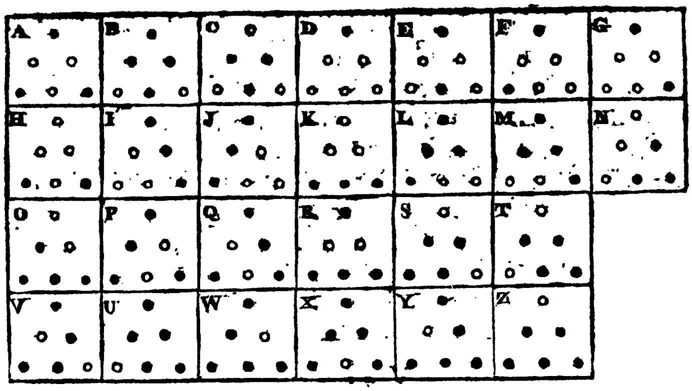
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 124.] SATURDAY, JANUARY 7, 1826. [Price 3d.

GAS-LIGHT NIGHT TELEGRAPH.





GAS LIGHT NIGHT TELEGRAPH.

SIR,—The prefixed drawings represent a Gas Light Night Telegraph, and key to the signals, of which follows a description:—

Numbers 1, 2, 3, 4, 5, and 6, are lanterns, with gas burners, fixed to ironwork of an equilateral triangular shape; each burner has a pipe communicating with the main, AB, which is connected with the gas-holder. VVVVVV are valves or cocks; they are opened by pulling the lines 1′, 2′, 3′, 4′, 5′, 6′, and are closed by a spring or weight attached to them. When a valve is opened, gas is admitted into the burner, and ignited by a very small jet of flame concealed in the upper part of the lantern, immediately over the burner.

The jets are supplied with gas by small pipes,* that branch from the other pipes below the valves VVVVVV, so that their communication with the main pipe, AB, is not cut off when the valves are closed; by this means the jets are kept constantly burning while the telegraph is in action. There should be a small oil gas apparatus in each signal-house.

The above Table displays an alphabetical arrangement of the signals.

Many other signals can be made. The black dots denote the lights shown.

With my best wishes for the success of your very useful publication,

I am, Sir,

Yours respectfully,

ROBINSON CRUSOE.

Portsmouth.

* The small pipes are not shewn in the drawing.

IMPROVED SYSTEM OF DRAINAGE.

SIR,—Permit me to give you an account of an improvement in the drainage of the fens, which has, within these few years, been introduced in this neighbourhood, and which promises to be of the utmost importance to the landed interest in Lincolnshire and Cambridgeshire. It is the substitution of steam power for the very uncertain power of wind, to raise the water from the low lands and deliver it into the drains and rivers. The district to which I now allude particularly, contains twenty-two thousand and ninety-six acres of land, which, in heavy rains, was in a great degree inundated: it was drained by means of forty-eight windmills. It often happened that, when there was most rain there was least wind, and the wind-machinery was useless at the time when it was most wanted. An Act of Parliament having been obtained for the improvement of the district, the Commissioners therein named thought it

expedient to call in the aid of scientific persons, and, accordingly, B. Bevan, Esq. whose name so frequently appears in your pages, was appointed to set out the drains and to give the necessary instructions for the execution of the work. The Butterley Company were consulted as to the machinery, and two large scoop-wheels were made under the direction of Mr. Glyn, their engineer. These wheels work in a case of hewn stone work, like a grinding stone turning round in its trough, and are well fitted to the sides and bottom of the case, so that the water may not escape past the float-boards of the wheel, which is not unlike the wheel of an undershot water-mill. The wheels being turned round by powerful steam-engines, lave or scoop the water over the embankment into the delivering drain, which conducts it to the sea. The second engine has now commenced working; it has a cylinder of nearly four feet in diameter, with a stroke of about eight feet, and is double powered. The wheel is about 28 feet in diameter, and the buckets are five feet wide and five feet deep, and the height from the bottom of the lower drain to the top level of the delivering drain is about 10 feet. The circumference of the wheel passes through seven feet in a second, consequently a stream of water five feet square is delivered at the same velocity into the discharging drain, or $5 \times 5 = 25 \times 7 = 175$ cubic feet per second, 175 feet × 60 seconds, gives 10500 cubic feet per minute, which, being multiplied by 6, gives 63,000 gallons per minute, or 3780,000 gallons in an hour. The load being uniform, the engine performs its work in the most steady and beautiful manner, and with perfect stillness, excepting the gushing sound of the water, whilst the ponderous machinery moves in the most majestic manner, as if it were conscious of its power and proud of its important duty. An idea may be formed of the strength of the parts when I mention that one of the toothed wheels, with its axis, weighs upwards of ten and a half tons.

I understand that the Butterley Company have several other engines in progress at their works in Derbyshire, which are intended to be employed in draining the fen lands of Cambridgeshire. It may truly be said that new channels will be opened for the employment of mechanical skill and industry. The farmers having seen the prodigious efforts of the engines now at work, have already given up the prejudices which new plans and alterations from old habits usually have to contend with, and they have so much confidence in them, that they have ventured to sow wheat and other grain on lands which were never before used for such crops. The cost of the whole is defrayed by a tax of twenty shillings per acre upon the fens so drained, which is levied by the powers granted by the Act of Parliament.

The engineers deserve the highest praise for the skill which they have displayed in the designs of so great a work, and for the firm and substantial manner in which they have been executed.

I have somewhat trespassed on your time, and perhaps occupied too much space, but the subject is one of such great importance to us, that you will excuse it.

I am, Sir,
Your obedient servant,
JOHN THOMPSON.

Spalding, Lincolnshire.

ROCKING STONES.

Upon S. Brown's farm, in North Providence (United States), three miles and a half from the town of Providence, there is a broad bed of limestone, which rises three or four feet above the surface of the earth. Upon this bed lie two immense bowlders of granite, one of which is so poised upon the imbedded rock and the top of its fellow, that it can be easily moved back and forth four or five inches with one hand, though it probably weighs eight or ten tons. It is even moved by the winds when they blow briskly from the south-east.

Another Rocking Stone is found on a farm belonging to Mr. Paine, of Smithfield, twelve miles north of the same town. It is a bowlder of granite, and reposes upon a mass of the same kind of rock. It is an irregular pyramid, fifteen feet in height, and twelve feet in diameter at the base. It is computed to weigh eighty or ninety tons. Notwithstanding its vast weight, it can be moved with the hand, and with a lever eight or ten feet long, it can be made to oscillate four or five inches. When moving, the rock appears about to tumble down the declivity upon which it is situate, and very few have the resolution to stand near its north-east side while it is moving. It is probable, however, that it will ever remain in its present situation; as many years since, a number of men, provided with levers, ropes, and even the aid of oxen, made an ineffectual effort to overturn it.

THE QUESTION OF SATELLITULÆ, OR LITTLE MOONS, CONSIDERED.

SIR,—I take the earliest opportunity in my power of expressing the great degree of delight and satisfaction I felt, on the perusal of Mr. Farey's ingenious speculation on the phenomenon of Falling Stars, as detailed in your 119th Number, page 102. According to that gentleman's statement, we are to suppose them to be small planetary bodies, revolving round the earth at no considerable distance from its surface, and occasionally ignited by their accidental approaches to the atmosphere of this globe. One cannot help congratulating the scientific world on the acquisition of so many new planets to the solar system; and almost, by anticipation, see the labours of future philosophers engaged in calculating their motions and magnitudes. With the disposition, however, to give Mr. Farey the fullest credit for his ingenious theory, we must not allow it, as yet, and in the absence of demonstrative proof, to sink deeper than to the imagination only; nor build a superstructure upon it, resting on no surer a foundation than the "baseless fabric of a vision," and like that, on the approach of the test of improved science, "leaving not a wreck behind." And I hope to make it clear, that planetary bodies, revolving round the earth at a distance from its surface no greater than the altitude of the atmosphere, must move with a velocity so great as to preclude the possibility of their ever becoming objects of observation. And I enter on this speculation the more willingly, as it elucidates, in a pleasing and popular manner, the principal fact which is the foundation of Sir Isaac Newton's philosophy. It will serve as a proof with how wonderful a degree of simplicity the motions of the heavenly bodies, intricate as they appear, are regulated and adjusted; and there is something highly sublime and astonishing in the idea, that the same moving force which whirls the planet Mercury round the sun in the short space of a few months—which never leaves the Georgium Sidus in his extended orbit of more than eighty years—and which recalls the comets, after their almost unlimited excursions into the regions of space, is

"Rul'd unerring by the self-same power
Which draws the stone, projected, to the
ground!"*

Most of your readers, Sir, are aware, that a body projected horizontally from the earth, as a ball, for instance, from the mouth of a cannon, will in a short time fall to the ground, and in its course it will describe a curve, which mathematicians call a parabola. Now, if we suppose the velocity to be more and more increased, it is evident that the body will fall at a proportionally greater distance. We may conceive this velocity to be so great, that the body will fall to the ground at a point diametrically opposite to that from which it was at first impelled, and that it will have described in its flight a curve, similar to the curvature of the earth, and nearly con-

* Vide a Poem, by James Thompson, to the memory of Sir I. Newton.

centric with it. In this case, if the velocity be increased ever so little, the body will never touch the earth, but will return to the point from whence it set out; and as it would come with a force and velocity undiminished (for the resistance occasioned by the atmosphere is not in this case supposed), it would continue to move in the same direction, and would really be a small planet revolving round the earth.

The question now is, to ascertain the time in which such a revolution will be effected; and, happily, the application of Kepler's celebrated rule will enable us to resolve that question. According to his rule, which has since been proved by Sir Isaac Newton to be an invariable consequence of the laws of motion, the squares of the periodic times of all planets, whether primary or secondary, are in proportion to the cubes of their distances from the centre of their systems. By applying, therefore, this rule to the moon, and to this new-created planet, and estimating the moon at her mean distance of sixty semidiameters from the earth, we shall find, after an abstruse calculation, of which it is unnecessary to trouble your readers with the particulars, that this new planet will perform every revolution round the earth in the short time of 1 hour, 24 minutes, and 36 seconds, at the rate of about five miles in every second of time—a degree of swiftness, this, almost surpassing thought; and only exceeded by the rapid movements which Shakspeare ascribes to the king of the fairies, who, to borrow the language of his inimitable poetry, can

> "Put a girdle round about the earth
> In forty minutes!"
>
> SHAKSP. *Mids. Night's Dream.*

I am, Sir,
Yours respectfully,
CHAS. ISHERWOOD.

Brotherton Vicarage, near
Ferry-bridge, Dec. 31.

THE "SIMPLE CONDENSER."

SIR,—In your 118th Number, I observe that a Morpeth Correspondent, who signs "C. T.," has given you the plan of a Simple Condenser, which, he "believes, has never been made in the same shape before." I beg, however, to inform him, that so far from the plan being new, it has been acted upon in Glasgow for upwards of twenty years.

One of these "simple condensers" has been used during that period for the distillation of water, &c. by Professor Ure, of Anderson's Institution (the parent of all Mechanics' Institutions), but it has several advantages over that proposed by your Correspondent. Instead of the inner cylinder being open at the bottom, it is closed up, and the cold water put into it. There is soldered on the inside of the inner cylinder a small open pipe, which reaches to the bottom *nearly;* on the upper end of this pipe there is a funnel, by which contrivance a constant supply of cold water can be sent to the bottom of the condenser, and the hot water on the top being displaced, runs over a small spout made for the purpose, into another vessel.

Your Correspondent will now see that his condenser is not new. But there is one more advantage in the Glasgow plan; instead of a cumberous cask, and an apparatus of no use but as a condenser, the Glasgow plan dispenses with the use of the former, and applies the latter to many other useful purposes. A bent handle of iron is attached to the outer cylinder at the top, so that when not used as a condenser, it is used as a common water can, and it thus becomes a very useful article for domestic purposes.

Perhaps C. T. has never been in Glasgow; if he has, I might suspect he was a plagiarist, as we have often found things, which are no new thing here, passed off as discoveries made southward of the Tweed.

I am, Sir,
Your obedient servant,
AMICUS VERITATIS.

Glasgow, Dec. 22, 1825.

P.S. In referring to Dr. Ure, I may mention, that about ten months ago he made a new Imperial Stand-

ard Gallon, so contrived that a child may fill it, and it will not vary the 10th part of a grain. The Lord Provost, and several other of the authorities, with the Professor of Natural Philosophy in the College, examined the measure a few days ago, and were very highly delighted with the ingenuity and mathematical correctness of the plan.

HINT TO PHILO-BOTANICUS.

Sir,—Being much attached to botany, I read with pleasure the offer made you by Philo-Botanicus, and wish to recommend to his early notice our noxious plants, as the poor are apt to gather every wild plant in the spring to eat with their meat. The danger of a mistake I shall illustrate by a quotation from the works of that great botanist, Ray: he relates the case of a man, his wife, and three children, who experienced highly deleterious effects from eating fried dog's mercury with bacon: this is one of our earliest plants, and is very common in hedges. As the flowers of plants generally, in drying, wrinkle, and the petals fall off, one or two flowers should be pressed in a book just long enough to flatten them, and then to be fastened with gum water at the bottom of the paper to which the plant is attached, and pressed till the gum is dry, after which they will keep their shape, and generally their colour, for many years.

I remain, Sir,
Your obedient servant,
W— I—.

CARRIAGE SAFETY-APPARATUS.

Sir,—In No. 116 of your Magazine a Correspondent ("Essex") suggests a brake to impede the velocity of a carriage going down hill, or to aid as a check upon a restive horse. There is nothing new in this suggestion, it having been long in use on the heavy French diligences, and has recently been so improved by an intelligent and attentive *conducteur* of the name of Hebert, who belongs to the establishment of l'Hirondelle, and goes the Paris and Calais road, that, by a very simple piece of machinery, he can impede and almost wholly stop the ponderous machine on a declivity without leaving the *imperiale*, which, as you well know, is a sort of cabriolet on the top of the diligence, and, to my mind, by far the most pleasant place for a traveller.

I remain, Sir,
Your most obedient servant,
V——.

Burton Crescent, 10th December, 1825.

NAVAL ARCHITECTURE.

Sir,—In your Magazine for November last, No. 109, page 419, I find an extract from an article of Colonel Beaufoy's, in the Annals of Philosophy, on Naval Improvement, in which he laments the little progress that has been made in the art of constructing fast-sailing vessels. The public are deeply indebted to this gentleman for the unceasing and persevering attention he has shown so long to a matter of such national importance; I therefore cannot refrain (through the medium of your useful publication) from requesting permission to offer my humble ideas on the same subject.

It is long since I have been convinced that there is considerable room for improvement in the construction of fast-sailing vessels, and I am of opinion that this is to be accomplished chiefly by a diminution of their breadth and depth, as applying to their midship body, retaining, at the same time, all the properties of stability, stowage, and windward qualities, by an increased length, without at all interfering with the various evolutions of tacking, wearing, &c. To this improvement may be added, that of a greater reduction in their draught of water; but it is not to be supposed that, were human ingenuity to arrive even at the greatest perfection, any thing could be produced to outsail our present fastest sailing vessels to such a degree as to be thought a phenomenon. If, however, a vessel is so built, which I think quite pos-

sible, as to outsail any other now in use in all points, and under all circumstances of proportionate sail, so much so that the one could never overtake the other, and *vice versa*, the end, no doubt, would be fully answered. The point, however, I wish to establish is, that almost every description of vessels constructed at present for fast sailing, viz. ships of war, revenue cruizers, yachts, &c. have too great a breadth of beam and depth of body, in proportion to their other dimensions, ships of the line excepted, which no doubt require it, to counteract their great height and upper works above the water; but in all single-decked ships it cannot be required to the extent which is now common, neither does it, indeed, bear any proportion to the other dimensions. We find 74-gun ships, of above 1700 tons, drawing only from 23 to 24 feet, while we have frigates drawing from 18 to 19, and 21 feet, whose tonnage seldom exceeds 1000 tons; brigs of 380 tons, drawing above 14 feet, and cutters of 150 tons, 12 feet: nor does the less draught of the latter forward, materially diminish or lessen the comparison in proportion to their reduced tonnage. These are points that appear to have been almost wholly overlooked by builders in general, as matters of little consequence, and appear only to be enforced where local circumstances of a light draught render it indispensably requisite.

If a vessel were constructed on the principle I have named, which I contend can be done without detriment to any one qualification others now possess, viz. having more stowage, equal stability, windward qualities, and less draught of water, she must have manifest advantages over all others.

But more clearly to demonstrate the construction I suggest I annex the entire half breadth and sections of two vessels of almost exactly the same tonnage, the one formed according to my own views, the other as that of vessels now generally used. Without being at all bigotted to my own opinions, I submit them to more competent persons to form their judgment thereon, begging to observe that it is, certainly, a matter of no little importance to attain greater perfection in the constructing of faster sailing vessels than those generally found.

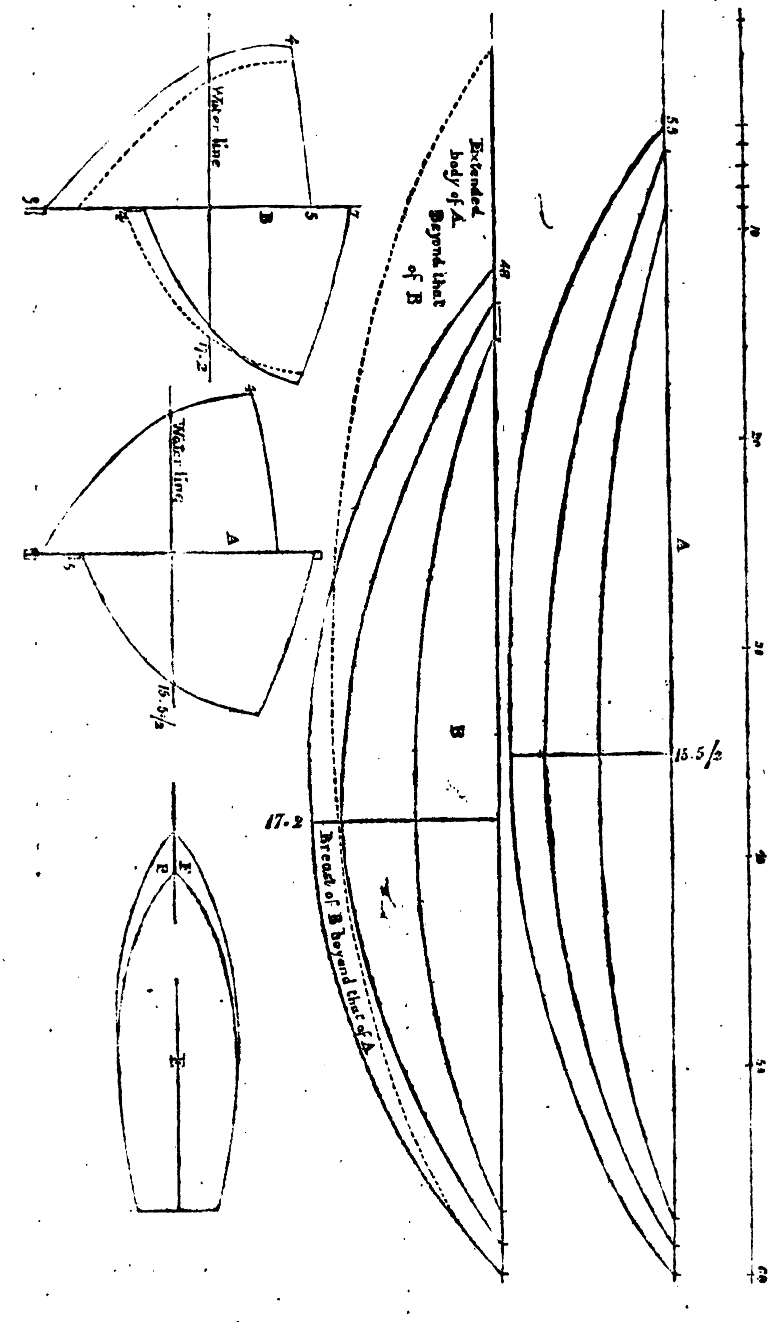
P.S. Since writing the foregoing article, your next Part, 29, has reached me, wherein, in page 11, I find an observation, signed Legis, on what he calls the swell or surge apparently rising at the bow of a vessel when passing rapidly through the water, and a suggestion that a temporary beak or prow should be applied to remedy this seeming obstacle to fast sailing.

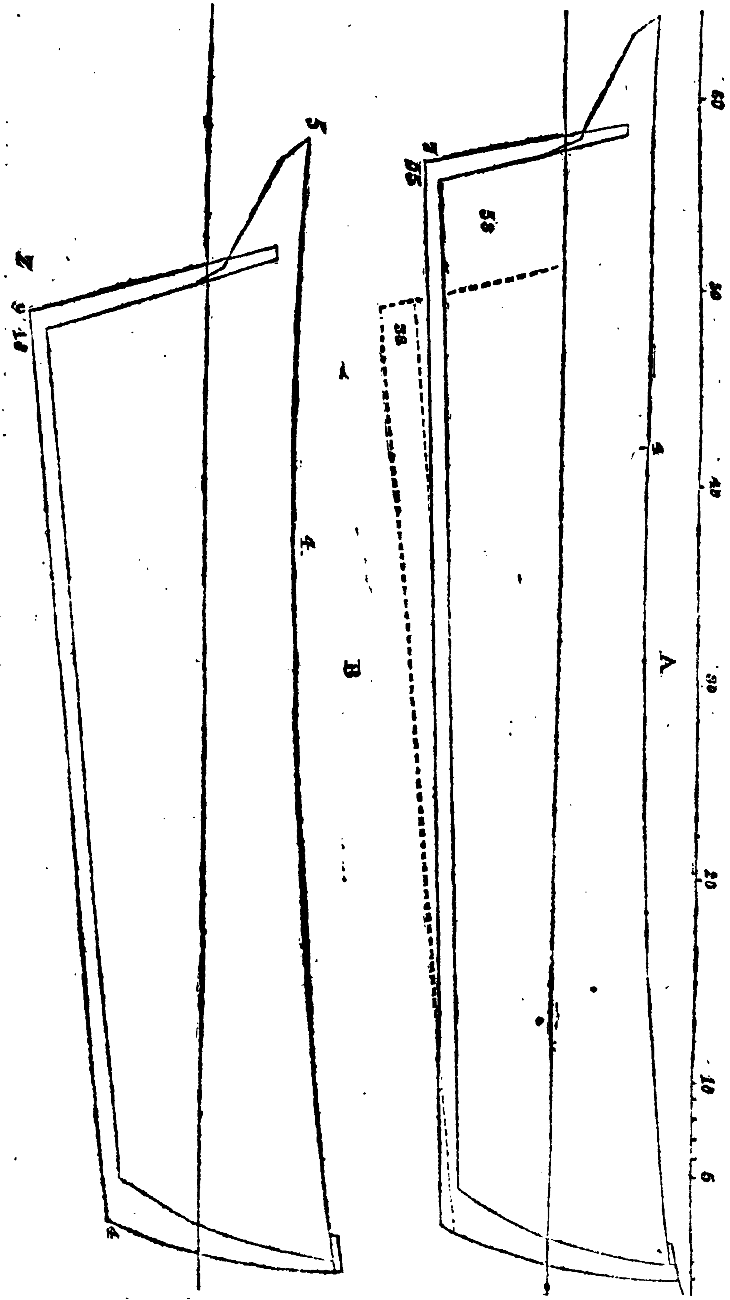
Legis will find, on inquiry, that for every one vessel that has been made wider or given more beam, at least one hundred have been lengthened at the bow, with a view, no doubt, to remedy the obstacle which has struck him so forcibly; so that, in these lengthened vessels, instead of meeting the main opposition to the fluid in passing through it within a foot or two of the stem, as heretofore, they now meet it not more than two or three feet before their main breadth in vessels of from 30 to 100 tons, which before occasioned the swell or surge he alludes to. In fact, it is now gradually introduced to its principal opposition, which, beyond a doubt, as gradually lessens its force.

A most valuable article follows this in the same Part, page 61, by Mr. John Major, in which are alone the true principles upon which any criterion can ever be produced as to naval improvement, and without which all future attempts to better naval architecture must be mere mystery and darkness. Perfection can only hope to be found by comparison; and I trust and hope that, although Mr. Major has not met with the encouragement he so much deserves, that he will, from time to time, make the public acquainted with his observations and discoveries, that more public-spirited individuals may avail themselves of them.

I am, Sir, yours, &c.

AN OBSERVER OF NAVAL ARCHITECTURE.


Water line
Water line
Extended body of A Beyond that of B
Bread of B beyond that of A
A
B
17·2
15.5/2
48


B
A
58
38
60
50
40
30
20
10
5

Description of the Drawings.

A represents the entire half-section of a vessel of about 500 tons, having 55 feet keel for tonnage, 15 feet 5½ inches beam, 7 feet draught of water aft, 5 feet forward; height out of the water at the stem 7 feet, stern 5 feet, midships 4 feet. The dotted line beneath the keel shows the depth of the vessel B, beyond that of A, in her after-frame, and the less forward, with also her diminished length less than that of A. Also, in the half-breadth section, wherein the water-lines are shown, as well as those of the midship sections, the less midship body of A, as to depth and breadth, being shown within that of B.

B represents the same form as the other, but having 17 feet 2 inches beam, and only 48 feet keel for tonnage; 9 feet draught aft, and 4 feet forward; in all other respects with the same upper works as A.

On comparing the two, it will be seen, that although B possesses greater beam, by nearly 1 foot 9 inches, with 2 feet greater draught in her after body, she has, in fact, less lee-board, or body, to keep her to wind beneath the water than A; the square feet beneath the water of that in B being only 38 feet in depth beyond that of A; while that of A, from her increased length, and consequently extended beaming, has 53 feet; leaving a difference in favour of A full 15 feet. And although B has 1 foot 9 inches more beam, it is partial, being confined to a short space; while that of A, though less, holds it in continuance, or dead flat, to a much greater extent, and retains it considerably lower down towards the keel, while that of B does not go much beyond her head-draught, it being almost impossible to form her water-lines so gradually to their termination of fineness, as in that of A, without making them hollow, consequently contradictory both to fast sailing and stability; while in those of A, from her increased length beyond that of B, has less breadth (if the word may be used), they almost naturally fall into gradual fineness at their termination, without the least hollowness whatever. It must also be evident, that although the bow section of A offers somewhat more resistance below, from having one foot beyond B forward, it lies in the narrowest part, and is still much less in square feet of actual resistance than B, while, at the same time, it lies in that part of the body which ensures windward qualities.

The figure E represents the form of a vessel whose bow is liable to occasion the swell or surge, which Legis alludes to. The outer line shows the proportion in which many vessels have lately been lengthened, to obviate the apparent obstacle he complains of.

FURTHER DESCRIPTION OF MR. MATTHEWS' SAFETY-GIG.

The numerous accidents occasioned by the tripping or falling of horses attached to two-wheeled vehicles, are, to reflecting minds, a drawback upon their pleasure in the use of them. The fall of a horse propels the seat of a common chaise or gig forward twelve inches, with a velocity which, with the ten miles an hour at which rate it may be going, gives to the body of a loaded gig a force nearly equal to two tons; and this, taking place at the instant a horse is recovering from his trip, seldom fails to throw him down. The better the horse, and the quicker his recovery, the greater will be the concussion, and the more likely his fall. This jerk breaks the shafts also, and dashes the persons occupying the chaise to the ground, and often with fatal violence.

Numerous yet unsuccessful attempts have been made to prevent these consequences, but no conceivable strength or weight of iron, or timber, if attached to the shafts, can be sufficient to sustain the weight of a horse moving at a great rate. All contrivances that have something to be done at the time of danger, are obviously useless; nor would any thing with an inelegant appearance be endured as a fixture to a gentleman's carriage. The mode by which safety is effected by Mr. Matthews, is as follows:—The steps are fixed to the body instead of the shafts; and from the under part of these steps, small scroll-irons reach to within a few inches of the ground. Thus, without any very visible appearance, the horse, by tripping, converts the front of this chaise into a sledge, that slides on the ground (the seat falling but one inch). The horse is not only thereby delivered from all weight, but two-thirds of it are thrown on the hind part of the carriage, and act upon the shafts as levers, with a considerable force upwards, so as to prevent his falling. This is done by that very trip, or jerk, which in all other two-wheeled vehicles would force him downwards.

The Safety-Gig does not profess to cure a confirmed stumbler, but it will prevent a good horse from being knocked down by merely tripping. A counterpoise is created, which gives him a perpendicular snatch at the moment in which it can be serviceable; so that it is hardly possible a horse with any activity will ever fall. If, however, he should, the shafts are made to descend and rise again without unseating or disturbing the occupants of the gig. On a recent trial, in which the horse did trip, the sledge or safety-iron came to the ground, and the weight being so removed from him he recovered; no concussion was felt, and, had he gone to the ground, none could have been, the chaise having descended as low as it could do.

By other trials, upon roads of the very worst description, full as they were of deep holes as well as ruts, it was found to be much safer than a four-wheeled carriage, and to be far preferable, as it rose with ease from holes that would, perhaps, have fixed the front-wheels of a coach. Unskilful drivers, or horses frightened, are as likely to run the vehicle against any thing with four as with two wheels.

It is by the fall of the horse only, that two are rendered more unsafe than four wheels; all danger on this head being removed by the Matthews' gig, it therefore claims a superiority over four-wheeled vehicles, by its being lighter and creating less friction. Hoods, though exceedingly useful, have for a long time been out of use, on account of their weight and heavy appearance. Matthews' patent chaise has an invisible hood; this, however, not being of so much importance, need not be added except particularly required. The hood is formed of silk, and concealed behind the stuffing when not in use. The first joint is raised in front, and this forms the hinge on which the remaining joints are raised from the back. It is light, and therefore can be put up quickly, and returned without much exertion. It is useful if nothing more be had in view than only to preserve the seats and lining dry, while standing at a door.

Doubts have been entertained by those who highly commend this invention, whether the fears of some very young men will not be too great for their adoption of the plan, lest they should be thought timorous. In reply to this—What would be thought of a Captain, who, through fear of being deemed timorous, would refuse to take an anchor to sea? Such an one would be the owner of a gig, who, terrified by the same cowardly dread, would act in a similar way. To be thus frightened into a disregard of the first law in nature—self-preservation, proclaims deficiency of intellect as well as cowardice.

Gigs of this kind are to be seen at Mr. Lambert's coach-manufactory, Jewry-street, Aldgate.

[We recommend to "A Builder" who has sent us a letter condemnatory of Mr. Matthews' gig, but whose knowledge of it appears to be derived entirely from the description in our 104th Number, to inspect the patterns of it at Mr. Lambert's, and then to transmit us his remarks upon it.—EDIT.]

RELATIVE MEASURES OF EQUAL WEIGHTS.

SIR,—I was lately present at a discussion which did not terminate exactly to the satisfaction of either of the contending parties, and, as it appears to me that the question may be fairly considered as belonging to that class of subjects to which your Magazine more particularly applies, I beg to submit it to you for insertion.

We were talking of the relative weights of an equal measure of differently sized shot, and it was urged, on one side, that, in loading a gun where the charge of shot is usually adjusted by weight, there would be a considerable difference of quantity by measure, whether the shot were very large or very small, or, in other words, that a pint of duck shot would weigh more than a pint of swan shot, supposing the specific gravity of the metal to be the same in both cases.

The grounds on which this assertion was made were, that the smaller were the globes the nearer would the mass approach to a solid, which must be of the greatest assignable weight that any given measure can contain, inasmuch as the nearer that approximation is, the less will be the aggregate amount of the interstices, on which alone the weight must depend.

On the other hand it was contended that the interstices would occupy precisely the same absolute space, whether the globes were large or small, for, that what they wanted or gained in number, was fully compensated by their increased or decreased size, so as that the sum total of the actual unoccupied spaces would in all cases be of equal dimension, and the weight, therefore, the same.

Which is the true opinion?

I remain, Sir,
Your obedient servant,
CLERO-MECHANICUS.

Gloucester, December 20, 1825.

SECRETS IN SELLING.

SIR,—I herewith send you a continuation of the article commenced in my last.

"In order to discover how the air's elasticity varies whilst its temperature increases, the experiments of Volta upon the dilation of air by heat, are extremely well contrived. Having taken a hollow sphere of glass which ended in a straight cylindrical tube, minutely graduated, and having carefully measured its capacity, he filled it partly with oil, the rest remaining full of air: then closing the orifice of the tube with his finger, and inverting it, he immersed it in a large vessel full of oil. Thus the included air rose to the top, occupying the sphere and the upper part of the tube, and in addition to the pressure of the atmosphere it sustained that of the oil corresponding to the altitude of the level of the vessel above the lowest boundary of the air in the tube. He caused the included air to pass through every degree of temperature from that of ice to that of boiling water, which he effected by heating gradually the oil of the surrounding vessel. He observed from time to time how much the air included in the tube expanded itself, and, as the pressure was always the same, he took care to go on elevating the tube at every observation, so that the lowest boundary of the air always remained at the same depth below the level of the vessel. He thus found that, under the same pressure for every degree of increased temperature as indicated by Reamur's thermometer, the volume of the air uniformly increased by 1-215th of the volume which it originally had at the temperature Zero, which amounts to 1-268th for every degree of the centigrade thermometer.

"Some time after the experiments of Volta, Gay Lussac, and Dalton, with different kinds of apparatus and by different modes of operating, confirmed these results. Before Volta the experiments on this subject, made by different philosophers, did not agree; almost all found the expansion of air not to be uniform; some made it greater, some less. Volta proved that these discrepancies arose from moisture, which was not excluded as it ought to have been. Operating on air that was perfectly dry, all the anomalies disappeared, and the true law and measure of the expansion of air by heat became manifest. Hence we infer that the density remaining the same, the elasticity of air taken at the temperature of ice increases by 1-268th of its value for every degree of increased temperature; for, in the above experiment, when t degrees were added to the temperature, the primitive elasticity ought to have been increased in the ratio of $1 + \frac{t}{268} : 1$, in consequence of the density having been diminished in the same ratio, but the elasticity remained the same, wherefore it increased as much by the increase of temperature as it ought to have decreased by the diminution of its density, that is, by $\frac{t}{268}$ of its primitive value.

Let P = air's elasticity, when density = 1, and at temperature 0° (centigrade thermometer).

Let p = elasticity, when density = q, and temperature = t,

$$\text{and } p = \text{P}\, q \,.\, (1 + \frac{t}{268})."$$

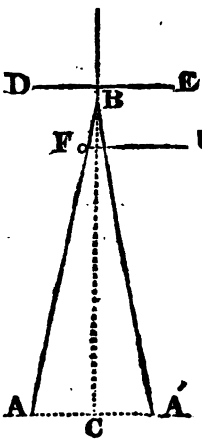
I remain, Sir,

Yours respectfully,

F. O. M.

Nottingham, November 26, 1825.

INCLINED PLANE FOR TURNING SCREWS.



If an inclined plane, AB, having AC parallel to the axis, DE, of a lathe, moves from C to B in a direction at right angles to DE during one turn of the lathe, a proper tool, F, applied to AB, and moving only in a line FG or GF parallel to DE, will form a right-hand screw, the thread of which will be equal to the tangent of the angle, ABC, multiplied by the distance, BC; or, in other words, the thread of the screw will be equal to AC.

If the plane is made to move from B to C, the screw formed will be a left-hand one.

And, also, if the plane is in the position A′B, it will form a left-hand screw when moving from C to B, and a right-hand one when moving from B to C.

To apply the above to practice, two parallel grooves might be fixed on the bed of the lathe at right angles to DE, at a sufficient distance to allow a rectangular plate of metal to slide steadily between them in the direction CB and BC.

On the edge of the sliding plate nearest the head of the lathe, there should be a rack to work in the teeth of a wheel deriving its motion from the arbor of the lathe.

On the upper surface of the sliding plate a series of grooves, to receive the heel of F, might be cut of different inclinations to CB, to suit the different screws that might be wanted, or (what would be better) a narrow plate, with a groove, and turning on a pivot on the sliding plate, would be easily adjusted to any required inclination by means of a scale engraved at AC on the sliding plate.

Now, should the wheel-work giving motion to the sliding plate be so adjusted that the sliding plate should be moved one inch for every turn of the lathe, a plate about twelve inches square might be made to cut screws from one-inch thread downwards, and, of course, as many turns of the screw would be formed as the plate would move inches; and if the scale was placed at the distance of 10 inches from the centre of motion of the turning plate, a screw of 100 turns to the inch would be represented by a division of 1-10th inch on the scale.

Should larger screws be wanted, the wheel-work might be changed so as to enlarge the motion of the sliding plate; thus, if it were made to move 10 inches during one turn of the lathe, screws up to 10 inches thread might be cut, but of course the number of turns of the lathe would be decreased in the same proportion, or a pantagraph might be used, adjusted to multiply in any required ratio.

The motion of F can be made parallel to DE by attaching it to the sliding rest, or any simple contrivance for the purpose might be easily added to the lathe.

MEASURING ALTITUDES.

Sir,—Permit a reader of your Magazine to offer a few remarks on a method proposed, in your 114th Number, for measuring the Altitudes of Objects by their Shadows; a method which appears to me to be totally erroneous, that is, as to its being practicable at any given altitude of the sun, which the proposer's proposition appears to imply; for we must all be well aware, that the shadows of objects are much longer than the objects themselves, when the sun is near the visible horizon. Hence I should like to be informed by your Correspondent, S. W. T., how he would apply his proposed method, as I cannot comprehend the lessening of any numbers by multiplication. Consequently, I naturally conclude that it can be applied only to one certain altitude of the sun; and if my conclusion is a just one, which I have every reason to suppose, the proposed method appears to be totally useless; but, on the contrary, should my idea of the proposition be false, further information on the subject, through your valuable Publication, in which I must beg you to insert this, would greatly oblige,

Your obedient servant,

Wm. D——y.

Taunton, Dec. 22d, 1825.

NORTHERN EXPEDITION.

Sir,—Will you allow me to beg the favour to be informed, through the always accessible medium of your valuable Magazine, whether, on sounding the wells of the ships upon the several arctic expeditions, the bilge-water was found at any time to be frozen? Should this inquiry meet the eye of any individual who may have had the honour of being upon those expeditions, and acquainted with the fact, I shall feel obliged by a communication, for a practical purpose.

I am, Sir,

Your most obedient servant,

Indicator.

SECURING LINCH-PINS.

Sir,—The suggestion of your Correspondent "Flint" is a very good one, as a plan for securing Linch-pins has been wanted and but little thought about; but as a tempered steel ring would be liable to break, and every one would not be able to get them manufactured, perhaps the following scheme, which I think is more simple, as every plain blacksmith could make the article, will perhaps be considered an improvement, and likely to be found beneficial:—

Near the termination of the pin let a hole be tapped, into which a stout thumb-screw must be fitted, to be screwed in when the pin is used: the expense would be but trifling, and I think the simplicity of it gives it a decided advantage over Flint's improvement.

I am, Sir,

Your obedient servant,

T. M. B.

December 17th, 1825.

WHY DOES A RAZOR CUT BETTER AFTER BEING DIPPED IN HOT WATER?

Does it? I doubt it.

Mr. Bernado, the best razor-maker I ever knew, told me it was very detrimental to a razor to dip it in *hot* water; and he recommended me, in cold weather, to place my razor in the bed from which I had just risen, or wear it in my breeches pocket (as all barbers of the old school do) till it was a little warm. In moderate weather, rubbing on the palm of the hand is the best mode of warming a razor, according to my experience for above fifty years.

Dei Gratia.

HINTS.

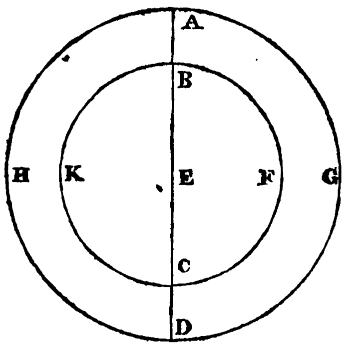
Gum-lac may be dissolved in a solution of common borax: perhaps this composition would answer as a fixer for chalk and pencil drawings, an inquiry for which I recollect having seen in the Mechanics' Magazine.

Query. Could not a metallic composition be discovered which shall have so little affinity for polished steel as to allow a pivot or axis to turn upon it without sensible abra-

sion? Such a composition might supply the place of jewels in centres of watch-work. I apprehend some alloy of tin and copper would answer the purpose, but have no present opportunity of ascertaining the fact by a set of experiments. M.

SOLID AND HOLLOW CYLINDERS.

Sir,—I send you the following attempt to answer the question of G. S.



Let AGDH, BFCK, be the outer and inner circumferences of the hollow cylinder. Now, it is evident that the effort of a solid cylinder, AHDG, to prevent rotation round D, is in proportion to the surface × the distance, ED, of its centre of gravity, E from D.

Similarly, the resistance of a solid cylinder, BKCF, to rotation round D, is proportional to the surface BKCF × ED.

.·. Calling the radii R and r, and π the circle whose radius = 1.

The resistance of the annulus,

= resistance of larger cylinder,

ditto smaller,

or resistance of hollow cylinder to breaking = $\pi . R . (R^2-r^2)$.

It is evident that the resistance of the solid cylinder whose radius = 10 = $\pi . 10^3 = \pi . 1000$.

Hence we have this equation :—

$$\pi . R . (R^2-r^2)=2 . \pi . 1000,$$

$$\text{or } R . \overline{R^2-r^2}=2000.$$

Now, the quantity of matter being equal, we have another equation, viz.

$$\pi . (R^2-r^2) . l = \pi . 10^2 . l,$$

when l = length of the cylinder,

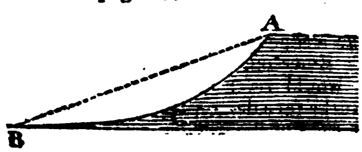
$$.·. R=r^2=100$$
$$.·. R=20$$
$$.·. R^2=400$$
$$\surd\ R^2-r^2=400-r^2=100$$
$$.·. r^2=300\ \surd\ r=\surd 300$$
$$.·. R=20$$
$$r=17.31.$$

I am, Sir,
Yours respectfully,
F. O. M.

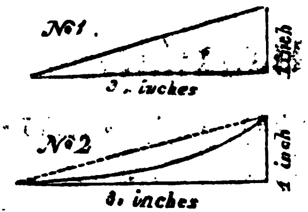
P. S. It may be interesting to many readers to know that a hollow cylinder is the form in which matter is placed to give the greatest strength, and hence, in the formation of the bones of birds, where the greatest strength is required with the least weight, we find this form adopted.

THE WEDGE.

Sir,—I am aware of the excellence of the Mechanics' Magazine, but I am at a loss to understand some of its writers, and of such is H—— F——, Fisher's-street, Sandwich, No. 102, page 277.



The error he has committed is so glaring, that every person in his right mind must see it, for, suppose he has to ascend a hill, A, from the foot, B, would it not be much easier to go upon the dotted line, BA, than to follow the curve line, BCA. I say, every man that knows the difference between a curve line and a straight line must perceive it is easier to follow the dotted line, BA. If it is not, our turnpike-road makers are in a great error, for they generally make the road as even as possible in the ascent: in doing so, however, I think they do right, and I reason, from analogy, that the straight wedge must be more powerful than the circular one; but, to prove the truth of this, I made two wedges, the one with straight sides and the other



with a circular side, No. 1 and No. 2. The wedge No. 1 was placed with its point under a certain weight, and required 14 oscillatory strokes to drive the wedge up to the head, A. I then placed the wedge No. 2 in the same position, and under the same weight, and it required 17 oscillatory strokes with the same pendulum to drive the wedge to the head, A. The curved wedge was made with a radius of double the length of the wedge according to H— F—'s direction.

From the above experiments I see the fallacy of H— F—'s law about wedges, and it is proved that he did not make the experiments correctly, or he did not make the wedges true; and, as there is so much said about the wedge by very able writers, such as Emerson, Smeaton, Banks, &c. I would refer the reader to their works for a demonstration of the real powers of the wedge.

I remain, Sir,
Your original subscriber,
G. A.

L. M. I. W. Nov. 19th, 1825.

RAZORS.

Sir,—Observing in one or two of your Numbers for October, some letters on the subject of a Razor cutting better for being dipped in Hot Water, I should wish to ask those Correspondents, why it is that a razor which has been used, and appears to have lost its edge, if laid by in a drawer for two or three months, when taken into use again, cuts better than it did before.

I am, Sir,
Your obedient servant,
S. R.

London, Dec. 27th, 1825.

NOTICES TO CORRESPONDENTS.

We beg again respectfully to request the office-bearers of such Mechanics' Institutions as have not yet favoured us with a return of the state of their Institutions at Michaelmas last, to furnish us with the same as speedily as possible. We propose, as soon as we have obtained all the requisite materials, to give a tabular view (as suggested by our Correspondent, Mr. Harvey) of the progress of this important branch of our National Institutions.

Communications have been received from Academicus—J. Brown, junior—A Constant Reader—Elisseus—Aled—Amicus—James S****—Mr. Dowden—A Subscriber—A Country Mechanic—M. G. R.—A Member of the Wadrington Mechanics' Institution—Satyr—M. Smith F. H.—T. Greenwood—J. Anson—Roger—J. F. F.—Windglass.

ERRATUM.

Sir,—In Mr. Macgowan's account of the New Measures, inserted in your last Number, there is an error in the rule for reducing the Winchester to Imperial bushels. It should be "deduct 1-33rd part," instead of "deduct 1-32nd part." Thus, 22 Winchester bushels, or 88 pecks, make 21 bushels 1 3-rd pecks, or 85 1-3rd pecks Imperial.

I am, Sir,
Your most obedient servant,
Nathan Short.

*** *Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

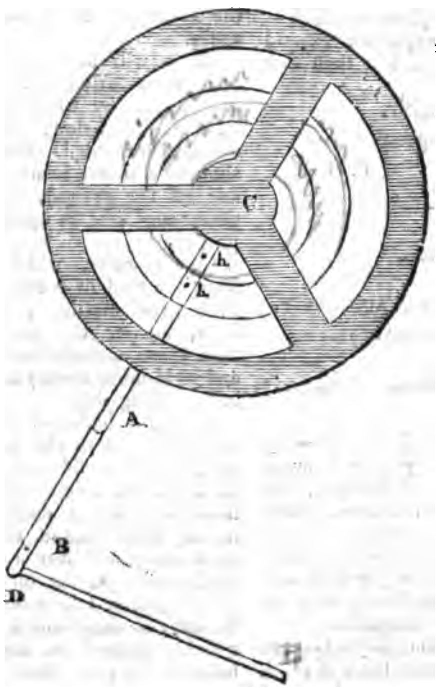
Printed by *Mills, Jowett, and Mills* (late *Bensley*), Bolt-court, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 125.] SATURDAY, JANUARY 14, 1825. [Price 3d.

REGULATING CHRONOMETERS.



SIR,—I wish to be informed by some of your Correspondents if any plan like the following can be made use of to regulate Chronometers, and preserve their rate in different temperatures?

The shaded circle and radii represent a balance-wheel.

The spiral line, the hair spring.*

hh, the studs fixed on the regulator, AC.

In the common watch the index,

* We are sorry to see this so incorrectly delineated by our draughtsman. The two separate inner circles occupy the place which should have been filled by the spiral or continued scroll. The letter of reference, E, at the end of the metal rod, D, has also been omitted.—EDIT.

A, is moved backwards or forwards, to release or secure a greater or less part of the hair spring, and retard or accelerate the motion.

Suppose ABD a lever, whose fulcrum is B; ED a thin metal rod fixed at E; then, as the temperature lengthens or shortens ED, it would turn the lever, DA, round B, and move the index, A, correspondingly, and thus regulate the watch. The lever, ABD, and rod, ED, might be placed over the balance-wheel case. I fear it would not answer, as the position of E, which ought to be fixed, would be liable to shift by the expansion of the plate on which it is fixed; this expansion would however, I think, be less than that of ED.

I am, Sir,

Yours respectfully,

F. O. M.

Nottingham,
November 26th, 1825.

PLAN FOR RAISING A SUNK SHIP. BY SIR JOSEPH SENHOUSE.

[*To the Editor of the Mechanics' Magazine.*]

SIR,—If you think the following method, which I proposed many years ago to the Admiralty, for raising up the Royal George, which sunk to the bottom at Spithead, can furnish any useful hints to those gentlemen who may be engaged in such pursuits, you are at liberty to insert it in your valuable Magazine.

Being told that the Royal George was surrounded with a bank of sand, accumulated by the tide, I apprehended that it would be difficult to move so ponderous a body till that was taken away; to effect which, I drew a plan for the removal of the sand; but this was not required, as I was informed afterwards she had fallen on a bed of clay.

I therefore respectfully proposed the following mode to be pursued in order to raise her off the ground, by the assistance of two seventy-four-gun ships, moored one on each side of the sunk ship:—

In the first place, I would have about 15 strong eye-plates, to be firmly fixed with screws on each side of the Royal George; these screws to penetrate through the bends into her timbers, which I conceive may be done by means of a diving-bell.

I would next recommend, that 15 hawsers, of 14 inches, and of a suitable length, should be doubled; then clap on a seizing near their bights, making eyes to fasten to the hooks before-mentioned, which should each have a clasp, or spring, to prevent these hawsers from coming loose again.

There will now be 30 hawsers from each lifting-ship, making 60 in all; and by fixing more hooks on the ship below, they may be doubled or trebled. But if all these should be found insufficient to lift her off the ground, an additional power may still be applied for that purpose.

Coir hawsers, which are made from the rind of cocoa nuts, from their great elasticity, would, perhaps, answer the purpose better than those manufactured of hemp, and yield more readily to the motion in the lifting-ships.

When the bights of these hawsers are made fast to the plates in the sunk ship, I would take both ends of them on board one of the lifters through a lower deck port, and passing them athwart the deck, put them under and over a beam fixed horizontally on the outside of the port opposite, taking both in again. To each of those ends I would have a tackle clapped on, hooked to the bolts of the port where the hawsers were first taken on board, by which means they may be made tight or slackened, as occasion may require.

To make the lifting-ships as stiff as possible, I would have a quantity of kentledge, or other dead weight, put at the bottom of their holds; and also prepare strong lockers in the wings of their orlop-decks, containing cannon-shot, ready to be moved from one side to the other, as may be thought necessary.

When the hawsers before-mentioned are hooked on the sunk ship, and the tackles hauled taught, at low water I would recommend the lifters to heel towards her; by this means she will come something nearer to the latter; but when you begin the great work, the shot should be carried back again to that locker where they were before. This will occasion a great accumulated power, because every beam in both ships will now operate in the manner of a lever to raise the ponderous mass below.

Having proceeded thus far, and if it be thought proper to postpone the business to a future day, the tackles attached to the hawsers may all be slackened, so as to suffer the lighters to rise up without their load.

But whenever this invention is put to a trial, and it is happily crowned with success, the three ships should then be towed into shallower water; on every succeeding effort the lifting ships will draw nearer to their object; and at the last time I would recommend to take advantage of a high spring tide to bring the Royal George as near the shore as possible, so that, in a low ebb, part of her upper works may possibly appear above water.

Having finished my plan for raising the Royal George, and likewise models of the three ships above mentioned, explaining more clearly my ideas on this subject, which fully answered the intended purpose, I showed them to the late ingenious Mr. Samuel Moor, then Secretary to the Society of Arts, &c. Adelphi, who was so pleased with them, that he thought they were deserving of particular attention: he therefore immediately mentioned them to Lord Viscount Howe, at that time First Lord of the Admiralty, in such a manner as made his Lordship very desirous of seeing them. According to his request, I waited upon him at the Admiralty with them, on December 14th, 1784. His Lordship examined every part with a seaman's eye, and wishing to understand the subject thoroughly, he asked many pertinent questions concerning them. My replies, I thought, were satisfactory to him; he was well pleased with my ideas of laying hold of the sunk ship, and highly approved of the small-sized cables I had chosen for the purpose, as, he observed, they were much more manageable than large ones. He also dwelt with much satisfaction on the method I had proposed to make all those hawsers bear an equal strain; at the same time acknowledging, that although many methods for raising the Royal George had been presented to the Board for their consideration, yet, in his judgment, he thought mine was the most likely to succeed of any he had seen.

At the conclusion of a long conversation on this subject, his Lordship asked me, if the Admiralty Board should wish to adopt my plan, would I undertake to remove the wreck? I answered, that in attempting so great a work, I was not then prepared to give a decisive answer; however, I was willing to give the best advice and assistance in my power on this subject, and would with pleasure attend the great work gratis. He then very politely thanked me for showing him my plan, and requested I would favour him with a copy of it, one of which I presented to him the following day.

I am, Sir, yours, &c.

Jos. Senhouse.

Hensingham.

THE BREWSTER WOOL-SPINNING FRAME.

The Brewster Frame, which derives its name from the inventor, Mr. Gilbert Brewster, a distinguished machinist of the United States, is so constructed, that by the continued rotatory motion of the main shaft, to which the moving power is applied, all the operations that are performed by the hand on the single domestic wheel, of drawing out, twisting, and winding up the yarn to form the cap, are perfected, leaving to the attendant no other labour than that of joining the threads as they may occasionally

break. The direction of the draft being vertical, the frame occupies not more than one-sixth of the space required for jennies doing the same amount of work, and enables the attendant to mend the threads with much greater convenience. The length of the draft, or quantity of slubing to be drawn out, and the time of throwing in and continuing the twist, being comprehended within the principle of the frame, they may be varied at pleasure. It is only necessary for the person in attendance, after ascertaining the description of yarn she is wished to spin, whether fine or coarse, hard or slack twisted, to adjust the frame with a wrench to the quality, shortening or protracting the period of the closing of the jaws on the slubing, as she may wish it finer or coarser, and varying the time of carrying on and off the belt from the twisting cylinder, according as she may desire her yarn hard or slack twisted. When once adjusted, the frame continues in the same state, producing an uniform thread, and possesses the additional advantage, from its mechanical construction, and the uniform regularity of its movements, of furnishing, if required, a thread slacker twisted for filling, and for warp one harder twisted, than can be spun on a jenny. The expense of keeping a frame in repair, and the power necessary for its successful operation, are not greater than is required by power jennies doing the same work. A frame of 300 spindles will spin 300 runs, 1600 yards to the run, per day, and will with ease turn off 100 pounds of four-run yarn in twelve hours. Two girls of sixteen years of age will attend a three-hundred spindle frame, one on each side.

ECLIPSES OF THE SUN.

Reply to a Question in page 123, vol. v.

SIR,—A question having appeared in page 123 of your Magazine, when we may expect a Total or an Annular Eclipse of the Sun in England? which question has been replied to by Astronomicus, in page 147; permit me to observe, that although in this reply the time of the next annular eclipse is correctly stated, yet your Correspondent has not decided which will be the first total eclipse of the sun in England; I beg leave, therefore, to supply this information by the following answer to the orinal question.

The first annular eclipse of the sun, visible in England, will be on the 15th of May, 1836, about three o'clock in the afternoon: it will be central at Mullin-Head, the northern extremity of Ireland; at Ayr and Selkirk, in Scotland; and about ten miles south of Berwick, in England. It will be annular for about half a degree on each side of the above line, which will, of course, include Londonderry, Glasgow, Edinburgh, Berwick, Newcastle, and the greater part of the county of Northumberland; at London, this eclipse will be exactly equal to that of September 7th, 1820, nearly 10½ digits.

There will be another annular eclipse on the 9th of October, 1847, which will be central at Plymouth at 20 minutes past seven in the morning; it will be annular in all parts of England of which the latitude does not exceed 51°, and perhaps a little beyond that limit, but the annulus will not quite reach London, the central track passing a few miles north of Paris.

The first total eclipse of the sun visible in England will be on the 11th of August, 1999; it will be central at Exeter about ten o'clock in the morning, and will be total in all parts of England in which the latitude does not exceed 51°.

The sun will be totally eclipsed at London on the 23d of September, 2090, about half past five in the afternoon.

All the above computations are for apparent time, and are made from the tables published in Vince's Astronomy. Hoping that they will prove satisfactory to your Correspondent

who proposed the question, as well as to your numerous readers.

I am, Sir,

Your most obedient servant,

ECLIPTICUS.

STEAM AND WATER ENGINES.

SIR,—I find, in No. 113 of your interesting Magazine, one of your Correspondents solicits some information respecting a Steam or Water Engine.

Let us suppose the engine to have 6 feet stroke, and the elasticity of steam to be 10lbs. per square inch, otherwise the answer will be indefinite.

Then $\frac{149800 \times 1000}{17280} = 8669$lbs. required to be lifted per minute, and $\frac{8669 \times 99}{32000} = 26$ 8-10ths horses' power.

$\frac{8669,00}{10.18} = 851$ gallons to be lifted per minute.

$\sqrt{\frac{26.8 \times 22}{.7854}} = 27$ 3-10ths inches, the diameter of the cylinder.

$\sqrt{\frac{5890}{33}} = 13$ 3-10ths inches, the diameter of the barrel.

$133^2 \times 2 = 35$ 3-10ths, the quantity of water per stroke; and

$\frac{851}{35.3} = 24$ strokes per minute.

If a water-wheel be found expedient, ascertain its maximum momentum, by denoting the constant velocity of the water by x, and the difference by y; between the velocity of the water and of the wheel, by y; then y^2 = force of the water, $y^2 \times x - y = xy^2 - y^3 = 0$, a maximum, or $2xyy - 3y^2y = 0$, $2xy = 3y^2$, or $2x = 3y$. Consequently the wheel will be a maximum, when the velocity of the water is to the velocity of the wheel as 3 to 2.

I am, Sir,

Your humble servant,

WM. TONKIN,

Mine Agent, Fowey, Cornwall.

MODE OF DIVIDING A QUADRANT.

SIR,—I send you the following method of dividing a Quadrant, which I have found to answer very well in practice. I have not met with it in the course of my reading, but it may, nevertheless, have been contrived by others as well as myself.

1st. Take very accurately the radius of the primitive circle.

2nd. Let the number on the scale which denotes this radius be cut in extreme and mean rates by the following theorem:—

Let R = radius,

m = mean proportional.

Then $R : m :: m : R - m \therefore R^2 = m^2 + Rm \therefore R^2 + \frac{R^2}{4} = m^2 + Rm + \frac{R^2}{4}$ $\therefore \sqrt{R^2 + \frac{R^2}{4}} = m + \frac{R}{2}$, or $m = \sqrt{R^2 + \frac{R^2}{4}} - \frac{R}{2}$.

If R be a general value for radius, then, in all cases, $m = \sqrt{5}\frac{R}{2} - \frac{R}{2} = R\,\frac{\sqrt{5}-1}{2}$.

3rd. This computed value of m, taken from the scale, gives the chord of 36° for that radius; hence, therefore, to find the chord of 36°, take the square root of 5 to 6 places of decimals, subtract 1, and divide by 2; multiply by the measured radius.

Having thus found the chord of 36°, we may use it as a check in finding the arch of 90°, by means of the 60° bisected; for, if the arch of 60° be bisected, and its half (30) added, we reach the extent of 90°; and if 36° be bisected, and its half added three times, we should also reach the extent of 90°.

It is not necessary to give a diagram, as any person, with good instruments, will find the method very exact, even on paper.

I am, Sir,

Your humble servant,

MONAD.

RESULTS OF A METEOROLOGICAL JOURNAL

FOR DECEMBER, 1825.

Kept at the Observatory of the Royal Academy, Gosport, Hants,

BY DR. BURNEY.

		Inches.		
Barometer	Highest	30.10,	December 24th—Wind	N.W.
	Lowest	29.00,	2nd	W.
Range of the Mercury		1.10.		

	Inches.
Mean Barometrical Pressure for the Month	29.571
—— for the Lunar period, ending the 9th inst.	29.701
—— for 14 days, with the Moon in North declination	29.782
—— for 15 days, with the Moon in South declination	29.620
Spaces described by the rising and falling of the Mercury	6.270
Greatest variation in 24 hours	0.600
Number of changes	2

Thermometer	Highest	55°,	December 17th	Wind W.
	Lowest	26	27th & 30th	N.W.
Range		29		
Mean temperature of the external air		42.82		
—— for 30 days, with the Sun in Sagittarius		45.52		
Greatest variation in 24 hours		16.00		
Mean temperature of spring water at 8 A.M.		51.88		

DE LUC'S WHALEBONE HYGROMETER.

	Degrees.	
Greatest humidity of the Air	98	in the evening of the 23rd.
Greatest dryness of ditto	54	in the afternoon of the 30th
Range of the Index	44	
Mean at 2 o'clock P.M.	82.9	
—— 8 o'clock A.M.	88.8	
—— 8 o'clock P.M.	86.4	
Mean of three observations each day, at 8, 2, and 8 o'clock	86.0	

Evaporation for the Month	1.100 inches.
Rain in the Pluviameter near the ground	5.325
Rain in ditto 23 feet high	4.810
Prevailing Winds, N.W.	

A SUMMARY OF THE WEATHER.

A clear sky, 3; fine, with various modifications of clouds, 11½; an overcast sky, without rain, 8½; foggy, 1; rain, 7.—Total, 31 days.

CLOUDS.

Cirrus,	Cirrocumulus,	Cirrostratus,	Stratus,	Cumulus,	Cumulostratus,	Nimbus.
17	10	30	4	9	25	24

A SCALE OF THE PREVAILING WINDS.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Days.
1	4	1	5	2	4	5	9	31

This month has been generally calm and wet, but very mild up to the time of the winter solstice, when the temperature of the air began to decrease; and a change of wind to the northward brought on several smart frosty days and nights. During the first five days 2½ inches of rain fell here, and in the night of the 13th nearly an inch was received in the rain-guage. From the prevailing humid state of the air near the earth's surface, and the little sunshine at intervals through the broken clouds, the evaporation did not amount to one-ninth part of that in July last. The mean temperature of the external air this month is exactly three degrees less than that of last December, but nearly a degree higher than the mean of that month for the last nine years. Spring water has decreased in temperature one degree and three-twentieths this month, and is one-twentieth of a degree lower than at this time last year.

About half-past two o'clock in the morning of the 14th, a trained meteor, of a large size, passed over in a S.E. direction, and spread a very bright light upon the ground, &c.

Soon after eight o'clock in the evening of the 22nd, an unusual variety of coloured rings appeared round the moon; the colours in order next to that luminary were—first, a dull silvery discus halo, bounded by rings of yellow, orange, different shades of green and purple, and these were encompassed by a dull red ring about ten degrees in diameter. This beautiful atmospheric phenomenon was immediately succeeded by a large colourless lunar halo, 44 degrees in diameter, then by a semi-halo, which gradually disappeared as the water-cloud, in which it was formed, passed off.

Till late in the mornings of the 29th, 30th, and 31st, icy efflorescences appeared upon the inside of the chamber windows, and in the evening of the 30th we had a slight sprinkling of snow for the first time this winter. At the close of the month the ice had accumulated to nearly an inch thick in the ponds and ditches, when the frost was suddenly broken up by means of the wind veering round to the south-west.

The maximum temperature of the air occurred four times in the nights instead of in the days—a circumstance peculiar to the winter season, when there is but a small variation between the temperature of the day and night, and the coming on of rain in the evening.

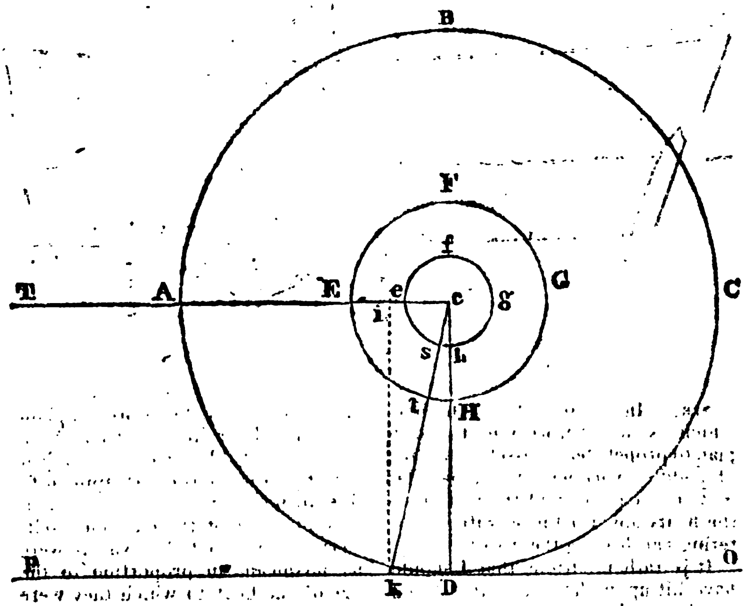
The atmospheric and meteoric phenomena that have come within our observation this month, are one solar and four lunar halos, two meteors, one double rainbow, lightning in the nights of the 2nd, 13th, and 14th; and three gales of wind, namely, one from S.E., one from S., and one from S.W.

PRIZE CHRONOMETERS.

It appears, from the official list for November, the seventh month, that five more of the Chronometers on trial are withdrawn, viz.—Baker, No. 782; Barwise, No. 185; Molyneux, No. 850; Tayler, No. 560; and Widenham, No. 945. We therefore give the remaining twenty-two in the order in which they stand for the prizes.

	No.	″
French	[illegible]	2,55
French	975	3,51
Harris	678	4,04
Molyneux	862	4,83
Desgranges	35	5,06
Cathro	1685	5,25
Finer and Co.	304	5,72
Tayler	602	6,09
Cathro	1703	6,33
Webster	638	6,34
Cotterell	637	6,67
Barwise	9234	7,19
Jackson	675	7,37
Cotterell	647	7,56
Jackson	512	7,59
M'Cabe	167	7,79
Webster	710	8,28
Porthouse	6281	8,61
Desgranges	20	9,03
M'Cabe	168	9,11
Ellicott	947	9,79
Lowden	2	10,47

IRON AND WOODEN AXLES.



SIR,—Should you think the following answer to J. W.'s inquiry (Number 158) concerning Iron and Wooden Axles, worthy a place in your valuable miscellany, it is at your service. Should I have taken a wrong view of the subject, I shall feel obliged to any of your more intelligent Correspondents who will correct me.

I remain, Sir,

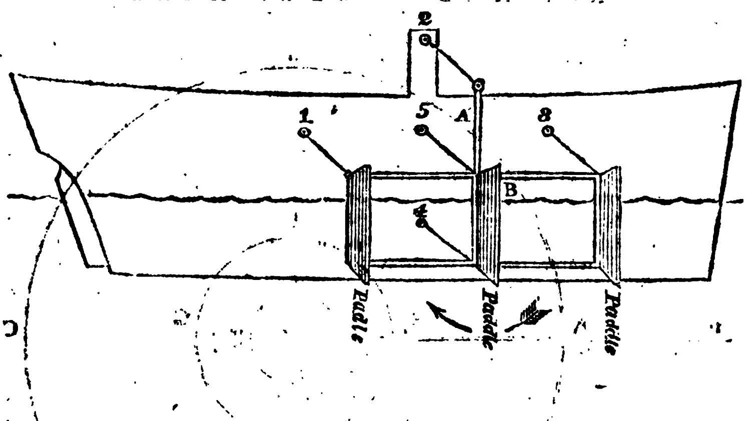
Your obedient servant,

J. RIDLEY.

Cresswell, near Morpeth,
November 19th.

Let ABCD represent the contour of the wheel; EFGH that of the wooden axle, *efgh*, that of the iron one, and *c* their common centre; Tc the line of traction, and PO the road. Then will the weight of the load, when the cart is at rest, be at the centre, *c*, and acting upon the vertical line, *c*D, with a power equal to the weight; then, supposing the draught to be equal to one-seventh of the weight, according to the laws of motion, the weight will be moved in the direction of the diagonal, *ck*, of the parallelogram, *c*D*ki*, whose sides are as one to seven, and cutting the contour of the axles in *s* and *t*, and acting upon the wheel in the case of the iron axle at *s*, and in that of the wooden one at *t*; but as the point *t* is evidently further removed from the line of direction, *c*D*s*, so much lever is gained, and of course will make the wheel revolve with less draught when the wooden axle is employed.

PADDLES WITH PARALLEL MOTION.



SIR,—In your 118th Number, which is now before me, I find a plan to propel steam vessels by means of paddles working with a parallel motion, so as to avoid the resistance the floats now used meet with on entering and leaving the water.

It is rather curious that I should have hit upon the very same thing nearly twelve months back, and wheels of this description were actually tried on a boat at this port in March last. A friend of mine, who is a most excellent mechanic, made the wheels and superintended the experiment, but I am sorry to say the result was not what I had anticipated.

As I have been for some years past afflicted with a complaint that confines me to my house, I could not be present when the experiment was made; I cannot, therefore, explain the cause of the failure: it may have arisen, probably, from a radical defect in the motion as applied to this purpose, or in the construction or application of the machine itself. Certain it is, that the wheels were by no means in proportion to the size of the boat to which they were attached.

Under these circumstances I would advise your ingenious Correspondent, Mr. Welch, to make an experiment himself. Perhaps a sketch of the apparatus that I used may be of some assistance to him, which I therefore prefix.

I am, Sir,

Yours respectfully,

ROBINSON CRUSOE.

Portsmouth.

BLOWING HOT AND COLD.

SIR,—I cannot say I ever discovered your Correspondent, T. M. B.'s, "well-known fact," that we blow hot and cold with the same breath. I blow or breathe on my fingers, when chilled, the breath from my lungs, because it is warmer than the atmosphere. I also blow my soup to cool it; yet it does not follow that I blow cold, unless it be in comparison with the soup. By blowing, I force a current of air on it of a lower temperature than the soup, the vapour above it, or the stratum of air immediately surrounding it. I never found I could lower a thermometer by blowing on the bulb, even with a pair of bellows, much less so by breathing on it a current of air hotter by several degrees than the atmo-

sphere generally is. The *fact* is, I believe, that in speaking of hot or cold, we do so by comparison with a previous conception. It is possible for the same body to *feel* or convey the sensation of heat and cold at the same instant. Let any one doubting this take three basons; fill one with water as cold as it can be procured, another with water at about 110°, or as warm as it can be conveniently borne, and let the last be filled with water at about 60°; now place one hand in the hot, the other in the cold water, for a minute; withdraw them both, and immerse them instantly in the other bason; the hand which has been in the hot water will now feel cold, the other will feel warm; yet the same water can hardly be said to be absolutely both hot and cold.

I am, Sir,

Your most obedient servant,

SATYR.

London, Dec. 14th, 1825.

CUTTING OF STEEL BY SOFT IRON.

BY THOMAS KENDALL, JUN.

From the American Journal of Science & Arts.

In the cutting of *revolving iron* by tempered steel, experience proves that there is a certain velocity beyond which it cannot be well and freely done. Much depends on the purity and state of the iron—much on the form, temper, and sharpness of the cutting instrument—much whether the work is performed dry or kept constantly wet with water or oil, and also much on the disposition of the particles of iron to chip. There is a great difference in different samples of iron in that respect, but much more difference in copper and its alloys, some of which, although sufficiently soft, can scarcely be wrought by turning, filing, drilling, or grinding. Whenever the steel or cutting tool, from any cause, ceases to act on the iron, and the heat is perhaps at the maximum, the iron, if revolving, will act on the steel; the greater the velocity the more freely it acts, and the progress is marked by different appearances corresponding with the different velocities. In the case of cutting a saw plate with soft iron, if moving with a velocity barely sufficient to act on the steel, this becomes heated beyond the cutting tool to a blue colour; if moving with greater velocity, no change of colour is seen, except on the burr raised by the tool; if with greater still, no change of colour is perceived, although the movement is attended by the *combustion* of most of the particles disengaged. These become ignited, because being connected with, and forming a part of the plate, they are by the motion disengaged with a velocity that does not admit of the transmission of the heat to the other parts of the steel. Perhaps the ignition is commenced, and carried to that degree denominated black heat, before the particles are separated, and is completed by the friction attending the separation. It is a fact, perhaps not generally known to those who have written on the subject, that *at the heat called black heat* (but which is, in fact, nearly or quite a red heat in the dark), *steel is broken or separated by fracture with much less force than when heated less or more*; the requisite temperature varying probably in proportion to the carbon contained in the steel.

The result of the copper wheel mentioned by MM. Darier and Colladon having no action on the steel, goes far to prove that the effect depends at least as much on heat softening the steel to a certain degree, as on percussion; copper having but little disposition to generate heat under any circumstances—a fact duly appreciated by the manufacturers of gunpowder.

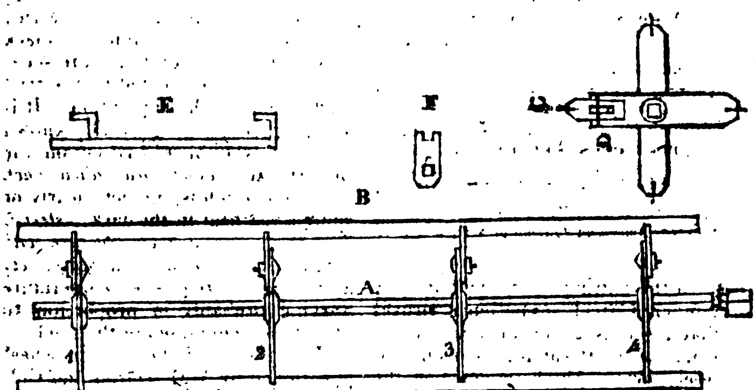
The reason why "the heat should be nearly all concentrated in the steel, and scarcely perceptible in the iron," I think to be this: the percussion against the steel is *continual*, but against any *one* part of the iron cutter, perhaps not more than from $\frac{1}{200}$ to $\frac{1}{400}$ part of the time; consequently the heat received by

such would be in an inverse proportion of the *thickness* of the steel to the *circumference* of the iron, after making the proper allowance for what may be thrown off from the circular cutting iron in its passage through the air, which must be considerable.

P.S. As evidence of the absence of heat, it is stated, in the memoir of MM. Darier and Colladon, that the small particles of steel adhering to the edge of the cutter, "seen through a lens, did not appear as if untempered, and when tried with a file, were found as hard as the best tempered steel."

I have never observed the appearance of the particles, or examined their temper, but have examined the burr raised in cutting a plate of steel, which before the operation was sufficiently soft to file with ease, but in the operation became hardened on the outer edge much harder than before, which was evidently caused by the great heat, and by being suddenly cooled by the current of air caused by the motion of the cutter; the same would be the case with particles disengaged by heat, or when hot, and adhering to the edge of the cutter. The process of hardening in air is applied by artists to the hardening of very small drills.

HAMMERSLEY'S IRON SILK-THROWING REELS.



SIR,—Being the inventor of a Wrought-Iron Reel for Silk-Throwing, and having put the same in practice at my own mill, having it in constant use, I can speak confidently of its great utility. The great disadvantage of the wooden ones, so common in use in every silk-throwing factory, led me to adopt a wrought-iron reel, which I have brought to perfection. The wood reels have long been complained of by the trade, ever since their first introduction into this country, as not keeping in guage or size. The disadvantage in making up the silk at the staff is great, the skeins being of so many different lengths; when at the dyers, also, in wringing out, some skeins have too much strain, while others have not sufficient, which must be very injurious in the production of silk goods, as the piece will not look equally well throughout. For the good of the trade, I beg, through your very useful publication, to make my improvement known. Many are the advantages which the trade would derive from iron reels, if generally adopted; among these I may mention, the great facility that can be given in stoving, as no heat will have any effect on them; that more

than double the quantity of reels can be dried in the same time; and that they always remain in guage, which is of the first importance. I have also weighed them with strong wood reels, and found them lighter, and they can be made cheaper.

Your insertion of this will greatly oblige, Sir,

Yours respectfully,

JOHN HAMMERSLEY.

Ilminster.

Description.

A represents a shaft or bar of 5-8ths square iron, with a baring or turned part to work on; at the end is a square socket, merely drove on hot—they will couple to each other in this way to any number of reels. Nos. 1, 2, 3, 4, are the crosses to support or fix the arms in; they are made out of flat iron, inch and 7-8ths wide, 1-8th and a 16th thick, which can be had to order; they are fixed together by two rivets, cross-cornered near the centre; a square hole is made in them sufficiently large to allow for wedging fast on the bar, A. On each side of the cross is a flat round collar, with a square hole to wedge up close to the cross; the ends of the cross are cut open with a cutter in the lathe, to receive the arms.

B represents the drop arm, which rises and falls by a chase mortice; when up, the mortice is up to the little bolts, and drops about an inch and a quarter; the little bolts are half-inch, with a good screw. I prefer a square thread: they are made square under the head, a little less in length than the two thicknesses of iron, in order to draw tight by the screws; the nuts are square, which by a wrench of sufficient length, with a T head, the four screw-bolts will be easily unscrewed from each end of the reel; the arm, B, will then drop, and let the silk slack for taking off. The long arms are drove down tight into the crosses, and notched a quarter of an inch on the crosses, to make it firm, and prevent the arms from ever moving endways.

C represents the cross as seen from the end of the reel. The short flat chase mortice-plates are made of iron, a little narrower, in order to receive a strong wire staple near the top, to prevent the drop arm moving sideways on the screw-bolts.

The line D represents the staple; by this contrivance it moves up and down in a line with the centre. The flat iron for the arms is an inch and a half wide, and about an eighth of an inch thick, which is found sufficient in strength for the pressure or contraction of the silk, occasioned by stoving. The crosses are cut about half an inch deep at the ends to receive the arms, and the arms are notched a quarter of an inch deep, and when driven together, finish to half the depth of the arms, as represented. As an additional security, to prevent the arms ever getting loose in the crosses, a wire stud might be driven through the arms, the side of the cross being grooved a little to receive the wire. If preferred, the drop arm may be made to fall by a blow with a hammer, instead of the wrench and screws, by an iron, E, with the crank ends passing under the ends of the drop arm, through a hole in the cross. Perhaps this would be the readiest and cheapest method; by this, there would be no screws or mortice in the plates of the drop arm required. The edge of the arms are made straight by hammering, and made of a round edge, and quite smooth. The edge of the arms may have a covering of thin copper, for a quarter or half an inch deep; this is easily put on by drawing the edge, with the copper, through a pair of rollers, with a groove in the rollers, similar to the covering of iron wire with copper; but I have used them without the copper lining, and find them to answer well by rubbing the bright edge with a little sand-paper, and greasing the edge with a little tallow; this will cause the skeins to move easy on the reel. I find them a firm, substantial reel, that will resist the effects of heat in stoving, and always remain in guage, and when varnished black, look particularly neat.

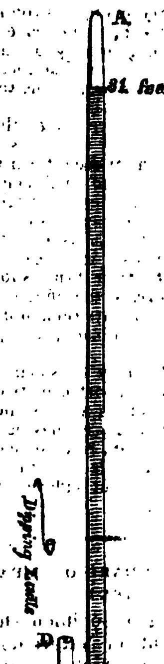
The iron, E, may be square, about half-inch iron, supported by two irons, as F, from the bar A; at convenient distances the two irons, F, may be open at the ends for the iron, E, to slide on; or, if preferred, the edge of the crosses might be notched out sufficient for the iron, E, to slide in.

NATURAL STANDARD OF MEASUREMENT.

SIR,—Being of opinion that the simple elements of Nature do afford materials from which an unerring standard of measure may be obtained, I beg leave to suggest the following mode, the principle of which is that of taking the weight of the atmosphere at a *given* pressure and adding it to a column of mercury in a short open tube, making these combined weights lift a column of mercury (in vacuo), in a long tube exactly 31 times the length of the mercury in the short tube.

The long column will be the standard sought, nearly equal in length to our present measure, 31 inches long.

The barometer shows that the atmosphere lifts mercury in a vacuum from 29 to 31 inches; it is, therefore, often to be found at 30 inches by index. I therefore adopt this weight, equal to 30 inches of mercury; and allowing it to press on an inch of mercury, I can raise a column of mercury exactly 31 times the length of the said short column of one inch, or equal to 31 inches, new measure, in an opposite connected tube.



ABCD represent a bent tube of glass, its height from A to B 34 inches, from C to D 4 inches; the bent parts below C and B will balance each other; the bore of the tube about half an inch. Suppose the atmosphere, equal to 30 inches, now pressing on a column of mercury one inch long from C to E in the short tube, these together will certainly lift mercury 31 inches high, that is, from B to *f* in the long tube; therefore it is manifest that the long column will be exactly 31 times the length of the short; and whenever these exact proportions are found by measuring the long by the short column, then the standard is produced, and this can always be found when the atmosphere is equal to 30 inches of mercury, as proposed.

The accuracy of the principle will appear when we consider that the most minute variation either in atmospheric pressure or quantity of mercury, will be detected by thus measuring the long column 31 times by the short one; for the 1-32nd part of an inch variation in the short, being thus multiplied 31 times, would make the line produced nearly 32 inches, while the long column may remain at about 31 inches. If we trace this calculation, we can prove that the one thousand and twenty-fourth part of an inch variation would show a difference of the 32nd part of an inch on the measured line compared with the long column: this measured line or comparing-scale may be of whalebone. This approaches near enough to an exact standard for commercial purposes, and I think proves that there is *perfect accuracy* inherent in the principle. The tube being filled in the usual way, and fixed in a frame, the mercury must be dipped out at D until it sink to 31 inches from *f* to B in the long column, and from E to C in the short column. The present inch will be useful in guiding us to the new measure sought, and they will approximate.

If, at the time of filling the tube, the atmosphere be at the adopted pressure of 30 inches, the dipping out or adding mercury at the opening, D, will soon produce the proportion of 31 to 1 in the columns; but the required pressure will be often attainable by moving the tube to a higher or lower situation, and the standard be found with less attention than is necessary to regulate a clock.

As mercury is in some degree affected by heat, one certain temperature as well as weight of the atmosphere may be adopted once for all.

I remain, Sir,

Your obedient servant,

Z.

CONCLUDING REMARKS ON MR. CRANE'S ALLEGED INVENTION FOR SAVING SHIPWRECKED MEN.

Sir,—I feel called upon, with your permission, to occupy a small space in your valuable publication, to explain to your numerous Correspondents the particulars of the above-mentioned invention.

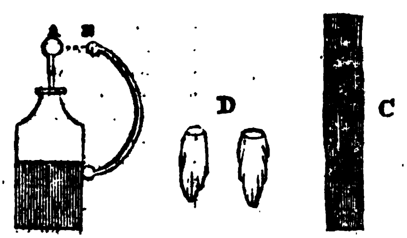
The above plan appeared publicly in the *Norwich Mercury*, a few months since, when the Editor complimented his fellow-citizen upon his ingenuity. I am not personally acquainted with Mr. C., and have no doubt but that he, and he alone, was the inventor of this plan. We must not suppose that Mr. C. could have wished to tear the laurels from the head of the original inventor, yet it seems remarkable that so precisely the same plan should have suggested itself to two different individuals. I feel much obliged to your Correspondents, "Stathmo" and "J. E.," for their information on this point, and hope they are convinced, that when I offered the above to the widely circulated pages of the Mechanics' Magazine, it was merely in hope of saving some valuable lives, by bringing the invention more into notice. In conclusion, I would observe, that

Your most obedient servant,

S. R. C,

is not the above "Mr. Crane" of Norwich.

SIMPLE POCKET ELECTRICAL APPARATUS.



Sir,—As the sun has now departed to animate with his vivifying beams the inhabitants of the southern regions of our globe, while it shortens the daily avocations of many of your readers, and as they will thus have, during the long evenings, greater opportunities for the cultivation of science, I flatter myself that many of them will be glad to hear, through your instructive and useful publication, how they may construct an Electrical Apparatus, which combines simplicity, portability, and economy, the whole expense not exceeding one shilling!

A is a small Leyden phial, to hold the charge.

B is the discharger, to discharge the jar when required, without electrifying the person who holds it.

C is a varnished ribbon, which communicates its electricity to the jar.

D are two hare-skin rubbers, to be placed on the middle and first fingers of the left-hand.

The apparatus is now complete.

and will perform many of the common electrical experiments. I have used it occasionally for some years with success.

To charge the jar, place the two finger-caps, D, on the first and middle finger of the left-hand; hold the jar, A, at the same time at the edge of the coating on the outside, between the thumb and first finger of the same hand; then take the ribbon in your right-hand, and steadily draw it upwards between the two rubbers, D, on the two fingers, taking care at the same time that the brass ball of the jar is kept nearly close to the ribbon while it is passing through the fingers. By repeating this twelve or fourteen times, the electrical fire will pass into the jar, which will become charged; and by placing the discharger, B, against it, as shown in the figure, you will see a very sensible spark pass from the ball of the jar to that of the discharger. If the apparatus is dry and in good order, you will hear the crackling of the fire when the ribbon is passing thro' the fingers.

To electrify a person, you must desire him to take the jar in one hand, and with the other touch the knob of it; or, if diversion is intended, desire the person to smell the knob, and he will experience a smart shock: this last mode has occasioned it to be called the *magic smelling-bottle.*

The apothecaries' 8-ounce phials form very good jars, and may be coated with tinfoil with a little trouble. I have made several, and one shock generally satisfies my friends. Who was the inventor of this simple apparatus I am not aware, but think it deserves to be better known; and if you think it worthy of a place in your excellent Magazine, you will greatly oblige, Sir,

Your constant reader,

GALVANUS.

Great Missenden, Bucks.

P.S. This apparatus will perform the experiment of the thunder-house, fire gunpowder, spirits of wine, and ether, and may be used for medical purposes.

INQUIRIES.

NO. 173.

HOW TO GET RID OF A ROOKERY.

SIR,—Will you allow me to ask, through the medium of your very useful, instructive, and amusing publication, what is the best mode to get rid of a Rookery, without shooting or destroying the birds? My object is to drive them from some trees, situated in the garden, close to the house, where they make a very great litter and dirt, in the spring, to other trees (of which there are plenty) at a very short distance. Perhaps some of your numerous Correspondents will have the goodness to inform me.

I am, Sir,

Your most obedient servant,

AN OLD SUBSCRIBER.

NO. 174.—TEMPERING STEEL.

SIR,—I am induced to apply, through the medium of your useful Magazine, for information in reference to the best method of Tempering Steel. Almost every smith, whether of town or country, professes to temper steel; of course it is done with very different degrees of success. One of the several methods is, I believe, to heat it to a certain degree, then to dip it in water, after which it is rubbed bright; and when the temper has run down to a straw, copper, or blue colour, it is plunged in cold water. But for this process it may be heated too hot, or not hot enough, so as to cause it to be too hard or too soft. The temper, I believe, usually considered most suitable to cut marble (which is the more particular inducement of the present inquiry), is a bright straw colour, which is commonly thus produced:—Heat that part of a chisel, or other article intended to be tempered, to a blood red; dip the edge in water, and when the temper has run down to a straw colour, cool it. But I do not know how far this can be depended upon as a general rule, for it will happen that a chisel, which

apparently shall pass thro' the same sort of process by a different hand, shall retain a temper different from that which it receives from the other. Of course there is to be taken into account the great difference in the texture of marble. Still I am convinced that steel is susceptible of a temper which will cut marble, with a greater degree of facility than what is usually obtained. It seems to require a certain toughness and sufficient hardness to penetrate easily; and when it does so, so as to leave a gloss after it, the temper is considered very good. When too soft, it does not lay hold of the stone; when too hard, it leaves a roughness, and does not readily penetrate. Cast steel and sheer steel are both used; some say the cast is best; I do not know if both require the same treatment. It is to be remembered, that tools used for the purpose of marble, and various other descriptions of stone, are frequently obliged to be sent to the smith, for the purpose of being fresh battered, on account of the liability to breaking, or becoming too thick for use. It is frequently said, that a good workman will work as well with bad tools as a bad one will with good ones. I do not pretend to dispute this maxim, still it is no less obvious, that if a person who might be accounted a good workman was to execute a piece of work with bad tools, and afterwards to do a similar piece with good ones, that there would be a striking difference in the working, as well as in the work, when executed. You will perceive, therefore, Mr. Editor, that I am assigning to the smith a greater degree of merit in the execution of work than what is generally conceived.

If any of your intelligent Correspondents should feel inclined to give any information, in reference to the best method of tempering steel for the purpose above adverted to, the object of your obliged Correspondent will be attained, and considerable benefit, I am sure, conferred on many others besides myself.

J. O.

Bath, Dec. 13th, 1825.

NO. 175.—BLUE CLOTH.

SIR,—The bad wear of Blue Cloths having been long a subject of complaint in the woollen trade, I should feel obliged if, through the medium of your Magazine, I could be put in possession of a test for trying its colour. The old practice of dying with indigo (I believe) always secured a good wearing cloth, but a cheap chemical process is now substituted, which renders the cloth equal in appearance, but has no wear at all in it. This is as frequently the case with the highest priced cloths as with cheap ones.

We have a test for all colours but blue, namely, by boiling them in vinegar, when, if they come unchanged from that process, they will wear well: this is not the case with blue cloth—it will stand that trial, and still wear white.

I have tried a strong mixture of vitriolic acid and water, which not at all affects its colour.

I am, Sir,
Your obedient servant,
J. O. B.

NOTICES TO CORRESPONDENTS.

R. H. not yet.

A. B. C. shall have the reconsideration he requests.

Communications have been received from H. R. W.—A. B.—G. A. S.—Old Brandy Boat—Nathan Short—T. W.—M. S.—Mechanicus—Nelly Homespun—W. E. H.—A Country Mason—R. R.—Essex—T. M. B.—Oyrtrio—H. G.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills, Jowett,* and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

Mechanics' Magazine,

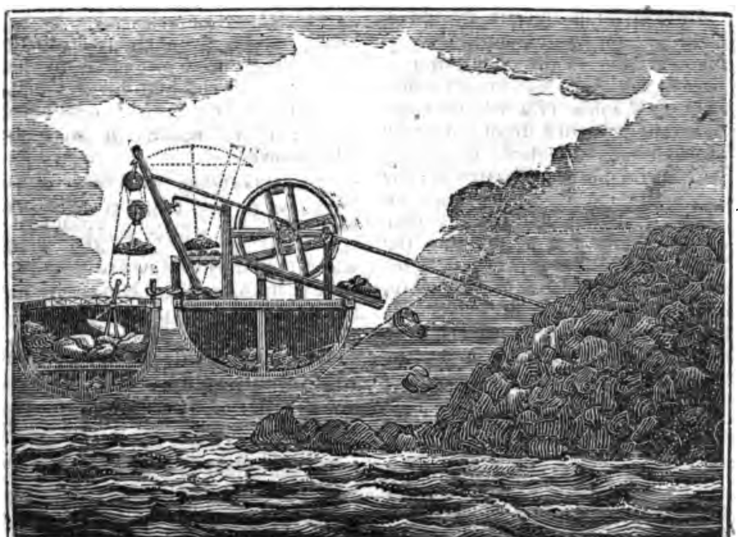
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 126.] SATURDAY, JANUARY 21, 1826. [Price 3*d*.

"The knowledge of mechanical powers is, of all others, the most radical and fundamental towards natural philosophy—such natural philosophy as shall not vanish in the fumes of subtle, sublime, or delectable speculations; but such as shall be operative to the endowment and benefit of man's life—for it will not only minister and suggest, for the present, many ingenious practices in all trades, by a connexion and transferring of the observations of one art to the use of another when the experience of several mysteries shall fall under the consideration of one man's mind; but, further, it will give a more true and real illumination concerning causes and axioms than is hitherto attained."—*Lord Bacon*.

CHERBOURG BREAKWATER.

[To the Editor of the Mechanics' Magazine.]



CHERBOURG BREAKWATER.

(To the Editor of the Mechanics' Magazine.)

SIR,—In the first volume of your most useful Publication (which has been only recently sent me, along with some other new productions of the English press), there is an interesting description of the Breakwater in Plymouth Sound; but I have been disappointed at not finding any where in the succeeding volumes the least notice of a similar work, of far greater magnitude, though possibly constructed on less scientific principles—I mean the Breakwater at Cherbourg. I have, therefore, employed a leisure hour in compiling, from some English documents before me, the following account of this stupendous French work, in the hope that you will deem it equally worthy of a place in your columns.

I remain, Sir,

Your obliged servant,

AN ENGLISH RESIDENT AT BREST.

9th September, 1825.

Description.

In 1781, M. de Cessart, Inspector-General of Bridges and Embankments, received directions to prepare a plan that should cover a fleet of 80 to 100 ships of war in the roadstead of Cherbourg, from the attack of an enemy, and protect them against the elements. M. de Cessart was fully aware, that, to raise a barrier in front of this roadstead, and in the middle of the sea, capable of resisting the impetuosity of the waves, and repelling the enterprises of the enemy, was no easy task. "Nothing," says he, "that I had ever performed, or that I had ever read of, in ancient or modern history, appeared to me to be worthy of being placed in comparison with the grandeur of this project." He suggested, as the preferable and only mode of answering the purpose of producing smooth water in the roadstead, that, in the place of one continued dyke or mole, a number of large masses, separated from each other, of a circular form, with an elevation greatly inclined, should be substituted; in short, a series of truncated cones, which, touching each other at their bases, might present to the sea, at the surface, alternate obstacles and openings, and thus interrupt and break down the waves previous to their entering the harbour. He also considered that, as these openings at the surface would not exceed 72 feet, a sufficient barrier would be formed against the passage of an enemy's vessel; and that, if necessary, in time of war, it might be rendered still more secure by placing strong chains of iron across the intervals. It was proposed to construct these conical caissons of wood, the number of which, to cover a front of 2000 toises, would amount to 90; which, at 360,000 livres for each cone, would cause a total expense of 32,400,000 for the whole. The number, however, was afterwards reduced to 64, and the time estimated for completing the work 13 years. Each cone was to be 150 feet in diameter at the base, and 60 feet in diameter at the top, and from 60 to 70 feet in height; the depth of water at spring tides, in the line in which they were intended to be sunk, varying from about 56 to 70 feet. They were proposed to be sunk without any bottoms in them, by which the upward resistance of the water acting on a base whose surface was equal to 17,678 square feet, would be avoided. The caissons, floated off by casks, attached to their inner and outer circumference, being towed to the spot where they were destined to be sunk, were then to be filled with stones to the tops, and left for a while to settle; after which the upper part, commencing with the line of low water, was to be built with masonry laid in pozzolana, and encased with stones of granite.

This plan of a stone dyke or breakwater being laid in detail before the Minister of Marine, it was deemed proper, on a subject so entirely novel, and of such great national importance, to consult the ablest men

in France before any steps should be taken for carrying it into execution. The details were accordingly submitted to the four Commissioners, M. de Borda, a naval officer, and Member of the Academy of Sciences; M. de Fleurieu, Capitaine de Vaisseau, and Director of Ports and Naval Arsenals, afterwards Minister of Marine; M. Peronnet, Member of the Academy of Sciences, Chief Engineer of Bridges and Embankments; and M. de Chezy, Inspector and Director of the School of Engineers. They recommended that, in the first instance, an experimental cone should be constructed, and floated off. Instead, however, of 60 feet in height, the cone made at Havre was only 36 feet; the circumference of its base 472 feet, and having a slope of 60 degrees; the upper circumference was 339 feet. Within the exterior cone, and at the distance of 5 feet 10 inches from it, was an interior and concentric cone, bound together by beams of wood, pointing to the common centre, each being the section of the radius. The frame of each cone was composed of 80 large upright beams, 24 feet long and 1 foot square. On these were erected 80 more, of 14 feet in length, making in the whole 320 of these large uprights; the machine was then planked, hooped, and firmly fixed together with iron bolts.

The cone at Havre being completed, the next operation was to tow it off to the particular spot where it was to be sunk. Being open at the bottom, it was found necessary to attach to the lower circumference 284 large casks, part to the exterior and part to the interior cone; besides 50 casks, attached by lines of equal lengths, from the bottom of the inner circle, to float towards the centre, and thus assist in keeping it upright and steady. It was easy enough, by these means, to float off a vessel of this kind. M. de Cessart observes, that the force of 7200lbs. produced by a capstan, was found sufficient to draw it on the water to a distance equal to the length of its own diameter, or about 25 toises, in two minutes.

"The success of the experiment made at Havre," says M. Curt, "had inspired such veneration for the conical caissons, that those persons who had been most disposed to object to the plan, were now obliged to be silent." The result of the experiment at once decided the Government to commence operations at Cherbourg. M. de Cessart was appointed director of the works, with four engineers to assist him. A permanent Council, consisting of Commanders-in-Chief, Directors, Engineers, &c. was ordered to reside, for six summer months, at Cherbourg, and the other six in Paris; and a considerable body of troops were marched down to the neighbourhood, to furnish a competent number of artificers and labourers, to be employed on this great national undertaking.

In 1783, the buildings were commenced for lodging the principal officers of the civil and military departments, and their respective establishments; a naval yard marked out and inclosed—roads of communication opened with the forts—and at Becquet, about a league to the eastward of Cherbourg, a small harbour was dug out for the reception of about 80 vessels, which were to be employed in transporting the stones from thence by sea.

On the 6th of June, 1784, the first cone was floated off and sunk, and the second on the 7th July following, in presence of 10,000 spectators, assembled on the shores and quays of Cherbourg; but before the cavity of the latter could be filled with stones, a storm, in the month of August, which continued five days, entirely demolished the upper part of this cone. In the course of this summer the quantity of stones sunk within the cavities of the two cones, outside their bases, and in the intermediate space amounted to 4600 cubic toises, or about 65,000 tons.

In 1785, three more cones were completed and sunk at irregular intervals; and at the end of that year the quantity sunk amounted to 17,767 cubic toises, or about 250,000 tons. In 1786, five additional cones were completed and sunk; one of them

in the presence of the King; and the quantity of stones thrown within them, and deposited on the dyke connecting the cones, amounted, at the end of this year, to 42,862 cubic toises, or 600,000 tons. In 1787, five more cones were sunk and filled with stones, making, in the whole, fifteen; and the distance between the first and fifteenth cone was 1203 toises, and the quantity of stones deposited within these cones and the connecting dyke, at the end of this year, amounted to 71,585 cubic toises, or more than 1,000,000 tons. The violent gales of wind that were frequent in November and December, carried away all the upper parts of the five cones which were sunk this year. In 1788, three more were sunk, but the upper parts of the first two were carried away as the others had been; the height of the third was, therefore, reduced, so as to be, when sunk, on a level with low water; but this cone was upset and soon went to pieces.

The enormous expense, and the delay that had been occasioned in completing and sinking these 18 cones, exhausted the patience of the Government, so that, in the following year, 1789, it caused the three cones, then on the building-slips, to be sold for whatever they would fetch.

The total quantity of stone that was sunk within the cones, and on the intermediate dyke, from the year 1784 to the end of December, 1790, being seven years, amounted to 373,359 cubic toises, or about 5,300,000 tons.

These 18 cones being sunk at irregular distances from each other, some being 25 toises, and others at 300 toises from centre to centre, occupied a line of 1950 toises in length. The distance of the first cone from the Island Pelée, on the east, was 510, and of the eighteenth, to Fort Querqueville, on the west, 1200 toises; so that the whole entrance or opening of the roadstead of Cherbourg was originally 3660 toises, more than one-half of which was now imperfectly covered by the breakwater.

The expense of this great undertaking was not, we suspect, accurately known, and could not probably be ascertained. M. de Cessart estimates the 18 cones alone at 6,231,407 livres, or about 260,000*l.*; and the total expense incurred between the 1st of April, 1783, and the 1st January, 1791, he states as under:—

	Livres.		
The value of the materials of the cones	2,462,369	9	6
The value of the workmanship	1,560,560	9	9
The conveyance and sinking of stones	14,880,074	2	5
Incidental expenses for buildings, magazines, &c.	2,359,489		
Contingent expenses....	395,926	13	4
Making the general total	21,658,420	0	0

Or 900,000*l.* sterling. In this estimate the extra pay to the troops and seamen employed, would not appear to be included; for M. de Curt, in his report to the National Assembly, states the total expense to have amounted to 32,000,000 livres, or 1,300,000*l.* sterling; and that a farther sum would be required, of 879,648 livres, to bring the top of the dyke to an uniform height, namely, a little above the level of the surface, at low water, of ordinary tides.

The number of people employed was prodigious. To enable M. de Cessart to complete and sink five cones a-year, he found it necessary to employ 250 carpenters, 30 blacksmiths, 200 stone-hewers, and 200 masons—in all, 680 artificers. The number of quarrymen and others employed in transporting 174,720 cubic toises of stone, for the 64 cones originally intended, or 13,650 yearly, was estimated at 400 workmen, 100 horses, 30 drivers, 24 chasses-marées, each carrying seven cubic toises, or about 98 tons, with 100 seamen; making an aggregate, for this service, of 526 men, and for the whole operation from 1200 to 1500 artificers and labourers, to which were actually superadded about 3000 soldiers.

A very considerable part of the expense might have been saved by dispensing altogether with the cones, all of which burst, as might have been expected, from the superincumbent weight of a deep column of water pressing the stones within against their sides. The 9th cone, which was sunk in 1786, went to pieces in 1800, after standing fourteen years; another reached the duration of five years; six remained on an average about four years; and all the rest went in pieces within a year from the time of their being sunk.

(*To be continued.*)

MINERAL DESCRIPTIONS.

(*To be continued occasionally.*)

LEAD.—This metal was called, by the old alchemists, Saturn; is of a bluish-white colour, and of great brilliancy when first cut or scraped, but soon after tarnishes: it is very soft, more so than any other metal; has no elasticity, and but a very faint sonorous power. To the taste it is somewhat sweet, and has a peculiar smell (not easily described) when violently rubbed. Its particles are endued with a very strong principle of adhesion, so much so that, if a leaden bullet be divided and immediately placed in close approximation, the two parts will adhere very firmly to each other, a property possessed by no other metallic body. The hammer will easily beat it, and reduce it into leaves thinner than paper. It has but little tenacity, as a wire formed of this metal will sustain but a small weight without breaking. It will mark paper, though not by any means so clear as plumbago. Its great weight, and its properties described, will make it easily known. This is a very abundant mineral, and is chiefly found in lumps and furrows. Scotland contains it plentifully, as well as the northern counties of England, and it is met with in almost all parts of the world. The greatest quantity of lead used in the arts is procured from a mineral called *lead-glance*, or *galena*, and which is a *sulphuret* of this metal. Siliceous and calcareous rocks contain lead ores; as also quartz, schistus, clay, and others. In Cornwall, *antimonial lead ore* is found, which contains a large proportion of antimony, with a little iron and copper. It is sometimes met with in the state of an oxide, and is often combined with silver, and also with bismuth. At Lead-hills, in Scotland, a native *carbonate of lead* is discovered, and which is the common white lead of the shops: there is another sort of carbonate, which is black, owing to the admixture of plumbago and iron. *Chromate of lead*, a most beautiful mineral, has been found only in a gold mine in Siberia. The green lead ores, which are known to mineralogists, are *phosphates*, and the *brown* is a variety of the same. In Germany and elsewhere, a straw-coloured ore is known, called *corneous lead ore*, which is a murio-carbonate; it consists of oxide of lead, with the muriatic and carbonic acids. There are other salts of this metal found native, but they are not much employed by artisans. The test by which this metal may be detected in liquids, or united with solid substances, is rather ambiguous. Sulphuric acid forms with lead an insoluble substance, and is sometimes employed to discover this deleterious article; but sulphuric acid, with many other bases, will unite in forming a body not soluble in water, for instance, with lime, and therefore cannot be relied on in cases of importance. Parke gives a method which, he says, is effectual, "Keep equal parts of oyster-shells and sulphur together in a white heat for fifteen minutes; when cold, add an equal quantity of cream of tartar. Put the whole into a bottle of water, cork, and boil for an hour; then decant the liquor into ounce bottles, and add twenty drops of muriatic acid to each. This liquor precipitates the smallest quantity of lead, which is held in solution in the sus-

pected fluid, forming a black sediment." Another method is by the addition of a little sulphuretted hydrogen in solution, or some hydrosulphuret, to any liquor which is believed to contain lead; and if any of it be present, it will give it a dark brown or blackish tinge. This, however, cannot be depended on, for it will also blacken solutions of bismuth, and some others. Pure water will not act upon this metal; but as most waters contain some metallic or acid particles, they will unite with the lead to form an oxide; hence the whitish crust which is often seen on the inside of cisterns. All acids act upon it more or less. It melts at 612° of Fahrenheit, being a much lower heat than is requisite for ignition; and when fused, it attracts oxygen from the atmosphere, and becomes covered with a pellicle of a grey colour. Its specific gravity is 11.35, which, however, has the property of becoming less by hammering. The uses of lead are many and important. Pipes for conveying water, the roofs of churches and other buildings, cisterns, domestic and chemical utensils, are manufactured from it. Enamellers, painters, and refiners, use its various oxides in their respective arts. In dying, calico printing, and the making of earthenware and porcelain, it is in request. Alloyed with tin, and sometimes with other metals, it forms pewter; it forms solder in another combination, and in a different one, buttons. The Romans were well acquainted with this metal, and its oxides were much used by them in the glazing of earthenware. Their ladies used some of its preparations as a cosmetic. It has many more uses, but they are well known to almost every one.

T. G.

Islington.

LONDON IMPROVEMENTS.

SIR,—The improvement of the metropolis has been more than once mentioned in your publication—the Mechanics' Magazine, and I beg to suggest what I conceive would add very considerably to its embellishment. It has been for a considerable time before the public, that a new Palace is to be built for the Sovereign, or that Buckingham House is to be remodled, or in part rebuilt. Considering that a more eligible spot presents itself, allow me to observe that the Green Park, as it is called, in which Lord Wm. Gordon's house stands, would be far preferable in many respects, but more particularly as elbow room would be given, which in all works of grandeur is absolutely necessary; but, in order to make the thing complete, I would remove the road from Hyde Park turnpike leading through the Park to Buckingham House, and open one from Piccadilly at the other, that is the White Horse Cellar end, for the public. Buckingham House might be dispensed with in that case, and the materials used in the new erection. Where would you find such another spot for a royal residence? It would be high and healthy, and well watered, with the finest opportunities of ingress and egress. Any number of carriages, in line, might be accommodated in the great street above, close to the pavement, and the nobility and gentry, when their carriages were wanted, might always find them, and instantly drive away.

I am, Sir,
Your humble servant,
E——.

METHOD OF RETAINING GOOD APPLES IN THE COUNTRY.

SIR,—It is a general complaint that the finest Apples of this country have degenerated, and that many of the best sorts have entirely disappeared from our gardens and orchards. It would not be difficult to show, that every successive grafting is a new pejoration of the fruit engrafted. By such proof the failure would be accounted for; but I shall only at present so far intrude upon the columns of your valuable Magazine, as to point out an effectual method of retaining good apples in the country without the pains of grafting.

In every perfectly ripe apple there will be found one, and sometimes two, *round* seeds; the others will have one or more *flatted* sides. The round ones will produce the improved fruit from which they are taken; and those with flatted sides will produce the fruit of the crab upon which the graft was inserted. It requires not a long time to ascertain the difference; for if a circle is drawn in rich ground, and the flat-sided seeds planted therein, and the round seeds in the centre, the variation of the quality will be discovered in two or three years; the first will throw out the leaves of the crab, and the latter the leaves of an improved tree, distinguished in shape, fibre, and a lanuginous appearance; and in due time the fruit of each will put every thing beyond a doubt.

It is to be observed, moreover, that the seeds of crabs (being originals) are mostly, if not altogether, *round*.

I am, Sir,

Your obedient servant,

W. D.

——, near Maldon, Essex.

PROPRIETY OF LEARNING MORE TRADES THAN ONE.

Sir,—Knowing by observation your great willingness to give a place in the Mechanics' Magazine to any suggestion which may tend in its operation to the bettering the condition of the operative classes, I shall not offer any apology for troubling you with this letter.

It has been with me a subject of much surprise, that mechanics should confine themselves to the learning of only one particular branch of a trade, when the advantages derivable from a knowledge of more than a single branch are so very obvious. For not only do they limit in this way their means of obtaining a livelihood, but contract their abilities into a narrower sphere; when, by having a concurrent knowledge of two or three branches of trade, they would have just so many more chances of disposing of their labour to the best advantage, and so many more opportunities of applying their inventive powers to the improvement of the arts of their country.

When a mechanic enters life, he fixes on that trade which he, by circumstances or inclination, feels will be the most desirable; or, perhaps, he fixes on a particular branch of it. When he does this, his whole occupation is to become master of it, and in a comparatively short time he is enabled to journey-work, and earn his own bread. But it is always the case (and at this it is that I am so much astonished), that he never turns his thoughts to acquiring any other trade whatever, but sits down contented with knowing his own. Perhaps, in a few years, when time and experience have mellowed his understanding, and made him a little wiser, he wishes he had done that which in his youth he neglected; but having tied himself to the oar, he feels the disinclination, natural to age, of entering into any thing new, which would cost him time and trouble to learn. I am well aware, that there are certain peculiar trades which a man must devote his whole attention and time to, on account of the particular workmanship they require, but such trades are not so liable to the casualties that common ones are. I do not think it is necessary for me to enumerate those manufactures where the plan I have been recommending can be practised with success; for, as I am writing to operatives, they themselves, in every trade, will feel and know what they could learn besides that which they already practise. The most difficult obstacles to be surmounted are prejudice and habit; but when even these are opposed to interest, they must give way. One of the greatest advantages to be drawn from this plan is, as before hinted, that if a mechanic does not find work at one branch, he may be able to turn his hand to another; or supposing the wages do not meet his wishes, or his ideas of justice, he may easily leave the work he is at, and take up some other. How often are mechanics at a loss for a living by the falling off of one particular branch of industry; and how often are thousands thus plunged, from comparatively a state of ease and plenty, into want and misery! With so many examples of this within our recollection, and so constantly recurring, surely the sensible operatives of the first country in the world cannot but have their minds alive to the importance of learning more than one of the numerous ramifications of industry by which bread is earned. I would but point out to their notice the state of thousands of those intelligent workmen, the Spitalfields weavers, who, by the operation of a law just now come in force, are thrown out of employ, and forced, *because they cannot turn their hands to any other work*, to become what they shun as a plague; whereas, had they been taught other businesses, or even *other parts of their own business*, they might not have

been, at least, so badly off as they are. And here I cannot let this pass without stopping to bestow some praise on the characters of these men, who, although suffering the severest distress, have not committed a single act of outrage. May not this be accounted for by the spread of education? I do not think I am saying too much, when I partly give the credit of it to your little book; and next, perhaps, to the establishing of a Mechanics' Institution, which also must, in a measure, be attributed to this invaluable publication. The fact is an answer to all the calumnies that may be heaped on such Institutes; and let those who do oppose them go among the mechanics of this country, and I am bold to aver, from experience, that a warmer-hearted set of men, and possessed of a better principle, are not to be found in the whole world. If the genuine spirit of the British people is to be found any where, it is to be found among those falsely called the lower orders, viz. the operatives.

I think, Mr. Editor, I have in this letter plainly shown the advantages to be derived by a mechanic learning more than one branch of industry. I more particularly address myself to the rising generation, who will be apt to practise the advice I have laid down, and I earnestly request them to give it their most serious attention, weighing the subject with an equable hand. To those whom I may style fathers, I would also urge the necessity of studying the subject; and if they are too old to learn, they may, at least, by precept, urge those whom they have under their care to the accomplishment of this very important task. I have no other object in view than the promotion of the welfare of the operatives of Great Britain, and that they may ever experience a goodly prosperity is my earnest desire; and, with my warmest wishes for the success of the artisans' best friend, the Mechanics' Magazine, I remain, Sir,

Their and your obedient servant,

H. B. T.

CAPTAIN MANBY'S PLAN FOR PREVENTING LOSS OF LIVES ON THE ICE.

At a season of the year when so many fatal accidents are constantly occurring from the falling-in of the ice while skating, it may serve the cause of humanity opportunely to reprint an Essay on the means of safety in such cases, which was read before the Committee of the Royal Humane Society, by Captain G. W. Manby, so well known for his successful exertions to save persons from shipwreck. We may at the same time refer our readers to some very good designs for a similar purpose, brought forward in the Mechanics' Magazine (vol. I. pp. 153, 433; II. pp. 29, 59), and which we are rather surprised have not been reduced before now to practice.

On saving Persons from Drowning at the breaking of Ice; delivered by Captain George Wm. Manby, *Esq. Honorary Member of the Royal Humane Society, before the Committee, assembled at the London Coffee-House, on the 19th of January,* 1814.

The loss of human life is always a subject of distress and lamentation; but when this calamity suddenly happens in the midst of health, and in the pursuit of active recreation, how deeply is our sorrow aggravated! Such is the unavailing affliction of the survivors of those unfortunate individuals who have perished by the breaking of the ice when they were enjoying the robust and healthy exercise of skating. These fatal events take place every winter, most of which might have been prevented, had there been prompt arrangements previously made, and ready means at hand for affording instant relief in cases of such extreme peril.

Among the many awful instances of this nature which occurred last winter, there was one in Scotland that demanded my most serious consideration. *Seventeen* persons were at one and the same moment precipitated into eternity!

The history of this truly melancholy event was related to me while I was in that country, employed in carrying into effect the humane intentions of Parliament for averting or lessening the perils of the storm.

The impression made on my mind by this shocking event, led me to

think and reason on the most simple and prompt mode of affording assistance to persons in danger of being drowned by the ice breaking beneath them.

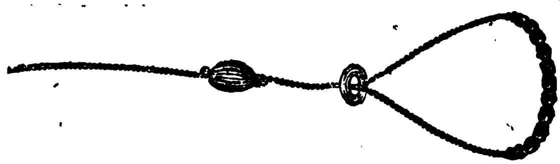
If the plan which I have lately devised, and now most respectfully submit to the consideration of the Royal Humane Society and the public, be adopted, I feel encouraged to believe it is not going too far to assert that drowning by the breaking of the ice will scarcely, if ever, hereafter occur.

I am therefore induced to recommend that it should be made known at those places to which skaters resort, that implements are now constructed for giving immediate assistance in every case of danger or difficulty to which persons on the ice can be exposed. This appears to me to be the more necessary when it is considered that the means heretofore in use, though they have sometimes been crowned with success, have too often proved abortive.

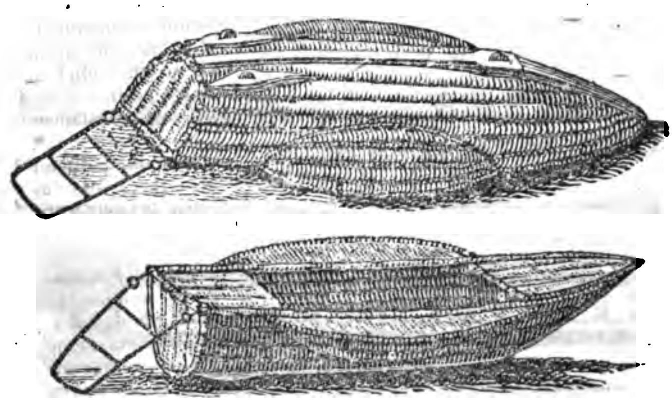
I now beg leave to enter into a detail of the new method here proposed, and will elucidate my suggestions by representing models before the Committee, who will at first sight perceive the simplicity which prevails through every part of this new apparatus; and I do most ardently hope that this system will not only be promulgated by your benevolent Society, but trust that it will be carried into effect throughout the kingdom, and indeed in other countries.

A Description of the new Mode of Saving Persons from Drowning.

The implements necessary for this purpose consist of the following articles, the application of which shall be presently explained.

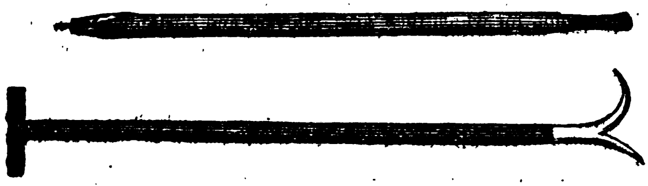


1st. A rope having a floating noose, distended by whalebone, with an egg-shaped piece of wood or cork, at a convenient distance to be easily grasped by the hand. The evident purpose of this rope, is to have it thrown to the aid of a person hanging by the edges of the ice, or liable to be drowned by its breaking.

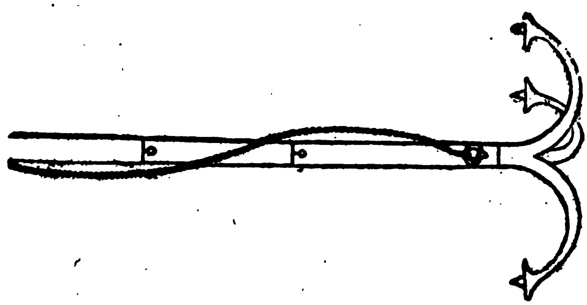


2nd. A *portable* gig-boat, made of *wicker*, for the advantage of extreme lightness.

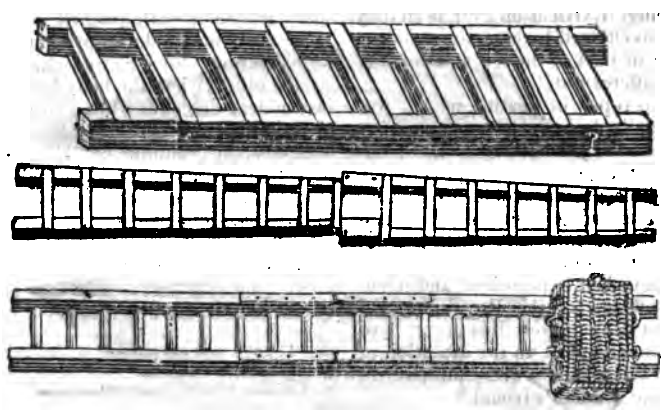
This boat is rendered unimmergible by air, and is made to stand upright on the ice running upon rollers.* It is to be used when, at the breaking of the ice, the distance is too great for throwing the rope, or when the means at present in use are insufficient to afford relief. The weight of a boat of this nature will not, I conceive, be more than 20lbs.



3rd. Sprits armed with iron points, which, by sticking in the ice, are used for impelling the boats forward.



4th. An *elongatable* grappling rod, which, in cases where the body has sunk beneath the ice, can be instantly adapted to any common depth of water, for the purpose of grappling for and bringing the sufferer to the surface.



* The roller in the fore part of the boat might easily be made to regulate the direction of the boat, but the sprit answers this end, and all unnecessary complexity is avoided.

5th. Portable ladders for communicating with the boat from the ice, in cases where the current may have carried the body from the place at which it first sunk. These ladders may be *lengthened* by *unfolding* or *fitting* in, and made *buoyant*, as may suit the occasion for which they are intended.

The implements now exhibited are to be applied in the following manner :—

Suppose a case, in which the ice has broken beneath a person, he naturally attempts to support himself by the broken edges. This he is generally able to do for some time if the ice be strong, as little is required to sustain a substance in the water. If the ice be firm, the sufferer may be saved with ease by the ordinary method of assistance ; but, if relief be prevented from approaching the broken place in consequence of fractures, or the evident weakness of the ice, the rope thrown by hand, if the distance be not too great, will save the person in danger. On the rope reaching the person, he will immediately lay hold of the egg-shaped piece of wood, and support himself by it, with one hand, while placing the distended noose over his head and under his arm with the other. He will then draw down the slide or button, with which the rope is supplied, to prevent the noose from slipping. Extrication from peril may be thus effected by a person standing on a safe part of the ice, and drawing the sufferer out.

This rope, or floating noose, was originally designed by me for saving persons from drowning at the breaking of the ice; but its application in affording prompt relief to persons falling or being washed overboard at sea, having met with such general and warm approbation from several distinguished experienced and scientific officers of the Royal Navy, I cannot deny myself this occasion of recommending it to the attention of this Society and of every philanthropist and seaman's friend.*

In these cases (which so often occur) where the fractured ice is so extensive as to be beyond the reach of ordinary assistance, or of throwing the rope, one of the boats just mentioned is to be used. They are expressly constructed to be as light, buoyant, and portable, as possible, as promptness in danger is the best and often the only assurance of success, for a moment's delay frequently proves fatal! Either of the boats can be impelled over the ice by one active man, with very great velocity, by his fixing the iron-pointed sprit in the ice, and forcing the boat forward by a powerful purchase of his arms.

For lightness, a boat *wicker*-made is the best of any contrivance with which I am acquainted. It may be rendered powerfully unimmergible by tin boxes enveloping air.

Supposing the person in danger to be holding by the edge of the ice when the boat is coming to his relief, the *stern* should be placed *towards* him, and, by a ladder which hangs over that part, the boat is easily attainable.

If the unfortunate person has been exhausted or benumbed by the cold, and has sunk before the boat could reach him, the *elongatable* grappling rod (always carried in the boat) is to be instantly applied, to bring the body up before the vital spark is utterly extinguished.

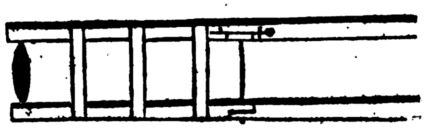
There is no mode at present, as far as I know, for effecting this desirable object when the body has unfortunately descended to a considerable depth. To obviate this great difficulty, the grappling rod is formed of several joints of any convenient length, say from six to nine feet long. The joints or sockets are all exactly of the *same* size, and fitting into each other indiscriminately, are secured by a spring, so that they are only to be put together till they form

* The Committee of the Society, during the late extreme frost, stationed men on the Thames and Serpentine rivers, who were supplied with the rope described by Captain Manby, and they cannot too warmly recommend it, from the great good derived by its use in preventing the drowning of a *great number* of individuals.—*Note by the Royal Humane Soc.*

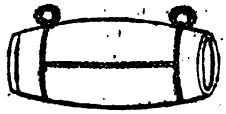
the proper length for the occasion, in one strong firm rod.

With this simple instrument the body may be grappled for, if a slight current, which often occurs, should have carried it under the ice. This may be quickly done with success. To prevent the possibility of the body being lost after being attached to the grapple, by the joints giving way, a rope is fixed by a ring fastened to the iron hooks, to which there are sharp *guarded* points for catching the clothes, or fastening to the body. The points being guarded, no material injury can be done to the flesh, let the hooks catch where they may. Very little force will bring the body to the surface when it is once attached to the grapple, from the well-known principle in hydrostatics which accounts for the buoyancy of any substance lighter than the same bulk of the fluid by which it is sustained.

If the body be brought up at a distance from the strong part of the edge of the ice, the portable ladder will be found extremely useful. One end of it is to rest on the ice, and the other on the boat; or it can be made buoyant by a thin air-tight box cased with wicker, as seen attached to one of the ladders.



Those who have been witnesses of accidents on ice, have observed that, from whatever cause, the lower parts of a person who has broken through, and is hanging on its edges, are drawn under the ice. The force of this in-draught always makes it difficult, and, under circumstances of numbness or fatigue, impossible, for the person in danger to raise himself by his own efforts to the surface, on which the ladder might be lying to receive him; I have, therefore, as seen in the engraving, about four feet from the end of the ladder to let down on hinges, that either, by drawing out the iron pin, or from the weight of the last stave, which is of iron, instantly makes it fall and hang vertically in the water, by which the person in jeopardy may, by a very small effort, get his feet on it, and easily ascend; thus answering the purpose of a platform, on which the body may be placed, and be drawn from where it is raised to a secure part of the ice. Should the distance between the boat and the edge of the ice be more than one ladder can reach, it may be lengthened by the addition of another ladder, made to fit (and fasten with a catch) with its narrowest end to the broader end of the first ladder. The ladder might be also made buoyant by a small cask (those in which tamarinds are imported are well adapted to this service, from the length of their form) slung in ropes, with rings on the top to receive the ends of the ladder, in the manner described by the figure.



I beg leave to avail myself of the present favourable occasion of submitting to the notice of the Committee a new Fire-escape Ladder, which I have just designed. It is simply a rope with nooses distended by flat rests for the feet, fixed at convenient distances for stepping from one to the other, and, in cases of danger, might be instantly fastened by one end to a table or bedpost, while the other is thrown out

of a window, and thus furnishes a ready escape from fire when, perhaps, there is no other possible means near those who are in momentary dread of being burnt to death!

Having made these incidental remarks, I have now briefly concluded my ideas on the facility of affording relief to persons exposed to perishing at the breaking of the ice; but there remains one object more, which I earnestly offer to your serious consideration. I am persuaded it is only through your benevolent Society that the plan I have just explained can be carried into effect. Your wisdom and humanity will no doubt make such arrangements as appear best calculated to promote the intentions of the Institution, and to gratify the feelings of your own hearts in saving the lives of your fellow-men.

In making this appeal I should wish to express myself in the most emphatic terms, because my declining health and strength from colds, which I have endured while employed in saving shipwrecked persons, preclude me from taking that active part for the benefit of humanity, which is one of the warmest and most powerful dictates of my heart.

GEORGE WILLIAM MANBY.
London, December 21st, 1813.

MEASURE AND WEIGHT.

[*Answer to a Question in page* 187.]

SIR,—In reply to the question of Clero-Mechanicus, in page 187, permit me to state, that a pint of duck shot and a pint of swan shot would weigh accurately the same, because, whatever be the size of the shot, the solid bulk of each sphere of which it is composed will bear a constant ratio to the interstice by which it is separated from the spheres in contact with it; this ratio is such, that if a vessel containing 100,000 cubic inches be filled with equal spheres of any given size, the quantity of solid matter contained in the vessel will be 74048 inches, and consequently the vacant space will be 25952 inches. Hence, if an imperial pint, which contains twenty ounces of water, be filled with shot, it will, in addition thereto, contain five ounces and three drams of water in the interstices; this result is obtained by calculation. If, on subjecting it to experiment, the quantity of water required to fill the cavities be found greater than here assigned, it will only prove that the shot are not so arranged that each may occupy the least possible space.

I remain, Sir,

Your obedient servant,

M— S—.

January 8th, 1826.

NAVAL ARCHITECTURE.

SIR,—As an old Lieutenant in his Majesty's navy, I cannot help expressing my joy that your useful and widely-extended publication has admitted communications on Naval Architecture into its pages. In a late Number I find a brother officer, of old standing, has given you some of his experience on the wooden walls of Old England, and I cannot help offering you my mite of knowledge to help forward the proper construction of our best bulwarks.

My ideas of ship-building in general are, that the French make the best models, but that our shipwrighting is better than theirs. The Americans, I think, seem to have beat us in both. When we first went out to the American station, in 1813, I expected that we should soon catch hold of the Yankees; so we had the Plantaganet, a kind of cut-down 74; but we soon found that our speed was not equal to theirs, and therefore we gave up cruising and stood to blockade. Most of our frigates sailed three or four in company, and though we often saw the enemy about Bermuda, yet we could not come up with them. I hear that the President, after she was taken by four of our frigates, was modelled

into our navy, and I am glad of this, because I knew her to be a run-away ship. As my brother officer observes of the Topaz, when the crack ships come into the English dockyards, they are often spoiled. Our people never take any care of the trim of a ship. Now it appears to me that it ought always to be preserved, by taking all manner of observations as to her form, equipment, and size of timber; but this, I suppose, would want more figures and geometry than our old shipbuilders have got. The young chaps from the College might, however, do it. I know that sailing depends as much on the captain as the builder of the ship, but then they ought both to do their part, and the more attention there is paid to the subject, the more, of course, will be known. I have been curious myself in this, and I have been surprised, on fitting out cutters, to find how little information I could get from the master shipwright on the nature and qualities of the ships entrusted to me, and by which the national welfare was to be promoted. If two or three young lads from our College at Portsmouth, who are very good scholars when they go into the Academy, and there study the best works on French naval building, were to be employed at our arsenals, it would be a great benefit in ensuring the good trims of our ships.*

If I am not tedious, I must say that our ships are over-timbered. Nothing works a ship so much as heavy iron knees, double bolted. The lighter a ship is, the better she goes over a sea. I have known our ships to work themselves to pieces in rolling; but this is not to be wondered at, since no figuring or accounts are taken of our best ships. Our fir ships are the best we have, and our oaken ones are just as thick-timbered as our fir ones. I have often been surprised at this.

T— W—.

* Our Correspondent seems not to be aware that many of them are already employed in the dockyards; with what effect, however, remains yet to be seen. —Edit.

Sir,—The letter of Philo-Naut, in No. 99, recalled to memory a few notes (made some time since) on the subject. My conclusions, however, (which, like Philo-Naut's, may claim the testimony of successful experiment) vary somewhat from his; but when "doctors disagree," your humble Correspondents may be allowed to differ without reproach to either. I shall, therefore, make a few observations upon his queries in order:—1st. His proportion of length to breadth is very good.

2nd. The proposed midship frame I do not so well approve. It requires a greater draught of water than I should be disposed to allow, for great draught of water is a great evil; and in the sketch before me it might be diminished one-half, without affecting the sailing qualities of the vessel. The forms of run and entrance do not depend so much upon that of the midship section as upon the floor-rising and water-lines; and as one example will be worth a thousand arguments in proof of this position, I would request Philo-Naut to observe the entrance of a *coble*, whose bottom is as flat as a tea-tray. The main breadth aloft should be continued well forward, in order to give a bearing when the vessel heels; if this be neglected, the utmost skill in other respects will be nearly vain.

3rd and 4th. The stern may rake or not, according to fancy, but the stern-post should always be upright, for the sake of steerage, unless the necessity of particular circumstances induce us to give an inclination.

5th. I am no advocate for deep keels; I do not think they possess any advantage to compensate their inconvenience. I have seen vessels whose keels have extended to nearly half the whole draught, but have not found their performance so far superior to others where the keel was not more than the third or fourth of the draught. I have also seen a small vessel very much after the construction proposed by Philo-Naut, but I cannot say that I was pleased with her behaviour. However, when

all has been said and done, much, I think, will depend upon the kind of rig; even in placing the masts there is room for the exercise of some considerable judgment. A change in the mode of setting the same quantity of canvas will make considerable alteration in the sailing qualities of the same vessel.

To conclude: Whether our vessel be short or full under water in the midship, I should entertain no doubt of her good behaviour, if only her water-lines be made to fall easily and gradually, and her floor rise regularly fore and aft. With respect to the main frame, the size of the vessel may be allowed to influence us in some degree; we may set it up, perhaps, somewhat sharper in a larger vessel; the other claims the first of our care in every dimension. It is strange that none of our mathematicians have thought of investigating a curve of least resistance suitable to this case. Such a curve may certainly be found; and I am much mistaken in my estimate of the wisdom displayed in the works of Nature, if *every fish that swims* does not happen to be constructed upon this very outline.

I am, Sir,
Your obedient servant,
MONAD.

FLAT ROOFS.

SIR,—In the 30th Part of your esteemed Magazine, the 118th Number contains an answer to an Inquiry, No. 155, on Flat Roofs, and as the replier turns querist, I beg to offer for your consideration the following observations on his ideas, and should you deem them worthy of insertion, I hope they may be useful.

First, then, the roof will not be a cheap one if the cement used be laid on very thick, and, without this, practice confirms that it will not be permanent; for the effect of a pliable ground-work, with a thin coating of cement spread over it, would be, on any pressure equal to a man's weight, a consequent cracking, and thus expose the building to constant leakage. The thick coating of cement is not only in itself expensive, but requires, from its weight, great strength, and consequently great expense, to support it; therefore the economy is not met. The permanency cannot be obtained unless the cement be solid, and to this not only the thin boards present an obstacle, but they are rendered a greater one by the soft and yielding nature of the rushes laid over them.

I am, Sir,
Your obedient servant,
Y— C—.

January 13th, 1825.

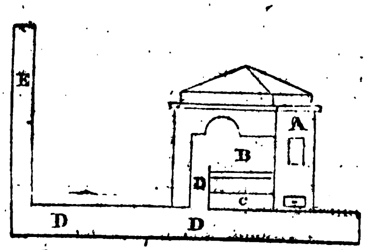
P.S. I have omitted to mention the expansion and contraction of the boards in wet and hot weather, which would have the same tendency to crack the short and brittle substances of the cement.

AIR STOVES.

SIR,—An Air Stove, of which the following is a rough sketch, will burn only in windy weather. Can any of your Correspondents alter the mode of setting, or give any directions how it may be made to burn in cold weather, when there is not sufficient current of air to cause a good draft?

I am, Sir,
Your obedient servant,
C. ROGERS.

Asgodby, near Market Razen,
Lincolnshire.



Description.

A, the stove.
B, the fire-place.
C, the ash-pan.
DDD, the flue.
E, the chimney.

INQUIRIES.

NO. 176.—PURIFYING WATER.

SIR,—I am proprietor and occupier of a farm, the soil of which is peat, for five feet deep, upon clay and sand, and I am much inconvenienced, particularly in busy seasons of the year, by having all the water requisite for the consumption of several families to fetch nearly two miles with a water-cart. We have plenty of water in the ditches which separate the different fields, but it is so strongly impregnated with the peat as to be unfit for culinary purposes. We could also collect more than sufficient from the buildings, by conducting the rain-water with spouts into a reservoir; but the water so obtained becomes impure, with a very offensive taste and smell, from the dung of pigeons, which occasionally rest upon the buildings. I should be glad if any of your intelligent and scientific Correspondents could inform me, how the peat-water of the ditches, or the rain-water from the buildings, can be *cheaply* purified, to render it available, to the amount of about twenty or thirty gallons daily, for household purposes.

My predecessor tried to procure spring water: he sunk a well, and, I believe, found a spring; but I am informed the water was not good, having, when it had settled a while in the well, a film of a red colour, upon it. When this well was made, the surface (peat) water was dammed out by puddling the top part with clay, but being done carelessly, it did not prove effectual—the peat-water soon drained into the well, and thus the attempt failed. Trusting that I shall receive some useful information,

I remain, Sir, yours, &c.

A SUBSCRIBER.

NO. 177.—BLEACHING.

SIR,—I shall be much obliged if any of your ingenious Correspondents will inform me of the method of Bleaching Linen *on a small scale.* The old mode of sunning and watering is very troublesome, and, after all, leaves the linen far from white. I am aware that muriate of lime is the principal, if not the sole ingredient, used in modern bleaching; but I cannot find in what proportions it should be used, and the mode of using it, being quite remote from those parts of England where the operation is performed.

I am, Sir,

Your obedient servant,

NELLY HOMESPUN.

St. N., Oxon.

CORRESPONDENCE.

"I am so stupid," Monad says, "that I cannot comprehend Mr. Monnom's mode of Screw-cutting (Number 95), for want of a figure. I have just read the article, for about the seventh time, to no purpose. Will he allow me to ask the favour of a drawing to accompany his next promised communication on this subject?"

V—— would much oblige several of the readers of the Mechanics' Magazine, by favouring them with a drawing of the Brake, suggested by Essex, in Number 116; and said by V——, in Number 124, to be actually in use in France, for the safety of carriages.

Communications have been received from—An Experimenter—Mr. Welch—Mr. P. Wilson—Aurum—Neux—Mr. Crosfield—S. G. (Strand on the Green)—Amicus—Aster—B. Q.—S.—H. N.—An old Master.—D.

Parts 31 and 32 will both be published on the 1st of February.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by MILLS, JOWETT, and MILLS (late BENSLEY,) Bolt-court, Fleet-street.

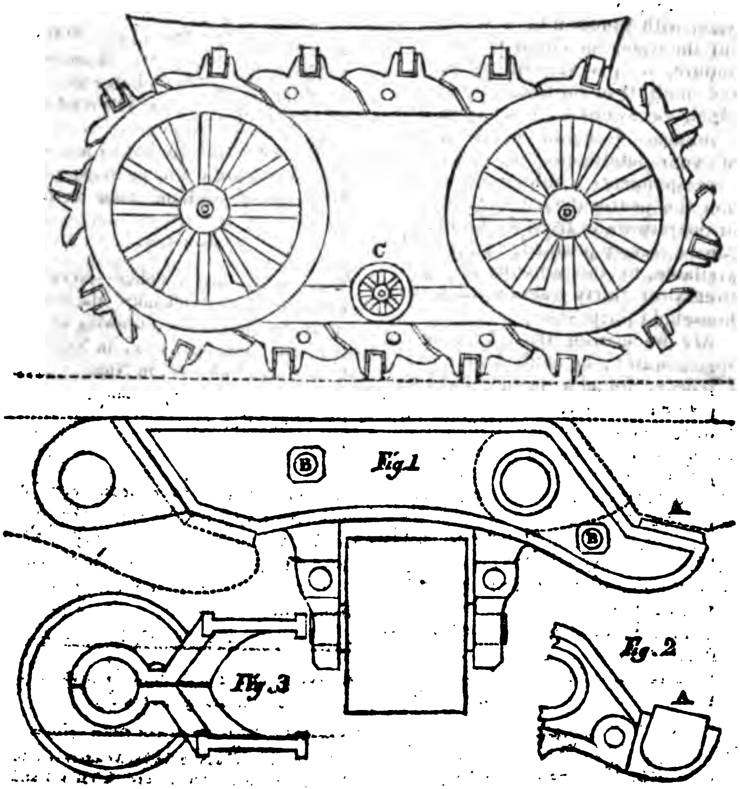
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 127.] SATURDAY, JANUARY 28, 1826. [Price 3d.

"That pains we take in books or arts which treat of things remote from the use of life, is but a busy idleness."—*Fuller*.

SIR GEORGE CAYLEY'S PATENT UNIVERSAL RAILWAY.



SIR GEORGE CAYLEY'S PATENT UNIVERSAL RAILWAY.

This vehicle is formed by two endless chains, consisting of portions of a railway so jointed that they form an inflexible right line when resting on the ground, but each capable of coiling round a fore and hind wheel on one side of the wagon, and thus of revolving with them (see prefixed drawings). Each joint carries with it a supporting piece or foot, which, in the engraving here given, is a small broad wheel, the line of its axle being parallel with the rail-chain. These, of course, give any required degree of lateral motion, but this movement is checked in the case of a road inclined towards one side, by a wheel placed on a hinged axle in such a manner as to operate laterally in the same way that a dray-pole does longitudinally when a carriage backs upon it: this wheel is not shown in the plate. Sledge-shaped feet are, on some occasions, substituted for these wheel-feet, particularly when broader supporting surfaces are necessary. Each link consists of a double frame of iron, with a space between them, so constructed as never to approach the two adjoining links within a couple of inches in any part but where the angular motion of the joint is stopped by a projecting piece of solid ash wood, resting on a flat face of iron (see A, fig. 1), where one link and its appendages are shown on an enlarged scale, and its connexion with the adjoining links by dotted lines.

A, fig. 2, shows a portion of the interior structure of a link, with the bed for the oak piece.

Fig. 3 is a transverse section of the rail on a smaller scale, showing the mode of mounting the small wheels, each link being cast or forged in two pieces united longitudinally, by transverse bolts, BB, fig. 1.

C, in the first engraving, is a wheel not touching the rail-chain, but close to its surface, to support the chain when exposed to violent strains. This rail-chain obviously adds considerable weight to a vehicle, and it can only be determined by experiments on a large scale, whether this evil is more than counterbalanced by the very advantageous mechanical properties it possesses.

It is obvious from the construction, that if this vehicle were pushed forward over a precipice, it would keep putting down its feet in an horizontal line in the air, till the line of direction from the centre of gravity passed over the edge, then the whole would balance over and fall together; but if another precipice at the same horizontal level were within reach of the leading foot before the vehicle did balance over, this foot would sustain the carriage in its path as correctly as if the way had been unbroken. Hence, as the hollow irregularities in bad roads will seldom, if ever, exceed half the length of the vehicle, these will not in the slightest degree effect the smooth course of the machine.

With respect to hard points that rise above the ordinary level of the road, three out of four will be avoided in the spaces between the feet; and as the number of points on which the chain rests must keep it about the average or middle height between the lowest and highest parts of the road, each elevated point that is hit by a foot will not cause more than half the immediate rise of the wheel on the chain, that the usual depression on either side will give to an ordinary wheel on the road.

In addition to these advantages, the elevation is converted into an inclined plane of the length of one link, upon which the fore-wheel ascends, and into a similar but reversed inclined plane down which the hind-wheel descends, thus restoring the power required for the rise.

Suppose, in a wagon to convey eight tons, the weight and friction of the rail-chain to take the full power of two horses, then, if two other horses drag four tons each (half their usual work on a railway), the result would be, that four horses

would drag eight tons, being double what they could effect in an ordinary wagon.

The subordinate contrivances, for ascending and descending hills, will be given in an ensuing Number.

ENGLISH GRAMMAR.

(To the Editor of the Mechanics' Magazine.)

SIR,—I have thus long deferred a continuation of my former communication, in the hope that I might have an opportunity of perusing certain objections to my remarks, which I understand have appeared in some other periodical work, and, consequently, of offering to your readers any further observations which might arise from a new view of the subject.

I have not yet been successful in my attempts to discover where these objections are to be found, and shall, therefore, steadily pursue my first object, observing merely, by the way, that, as the dissentient production does not appear in your pages, I cannot help thinking that it was never intended to meet my eye, and has been sent to another publication, with the hope of avoiding a discussion which, were it entered into, must ultimately place in its true light the stupid pomposity of those persons who would rather suffer their native tongue to dwindle into barbarism, than descend from the mightily elevated regions of classical literature to be vulgar enough to speak good English.

But, not to waste more time about what is so palpably evident, let us proceed at once to consider the nature of this science, which is encompassed by difficulties so numerous as to render it unattainable by so many persons of talent and education. I think we shall find the old adage verified, "Where there's a will there's a way," and that it does not require an extraordinary capacity to gain a competent knowledge of the simple and well-digested rules which regulate the construction of our language.

Language, then, is a collection of sounds made use of by any nation or people to express the ideas of their minds, and thus to render their thoughts intelligible to each other; and *Grammar* is nothing more than a collection of rules which teach us to write or speak after the best fashion, and in such a manner that our meaning cannot be misunderstood. It is divided into five parts, namely:—

Pronunciation, which includes the branches usually designated Prosody and Orthoepy.

Spelling, called also Orthography.

Etymology, which treats of the different sorts of words, and shows us how to vary them to express our meaning.

Syntax, which teaches us how to place those words in a sentence; and

Composition, which shows us the method of selecting and arranging sentences so as best to suit our purpose.

Attention to, and imitation of the best speakers, will do more for us, with respect to *pronunciation*, than all the rules which can be written; and Orthography is soonest learned by frequent reading, and the practice of copying from printed books. I therefore pass over these branches of the science, and proceed at once to

ETYMOLOGY.

This, as before stated, treats of the different sorts of words, and shows us how to vary them to express our meaning.

There are in English above forty thousand words; yet only nine different sorts of them, or, as they are technically called, *parts of speech*.

To make himself proficient at distinguishing these from each other, should be the first care of the student. A prevailing error of our modern grammarians is, that they pass over this part of the subject without giving or recommending a single exercise, to imprint the meaning of their definitions upon the pupils' mind. Hence it frequently happens, that boys at schools, who have toiled (perhaps more than once) through a complete Accidence of the language, are not able to distinguish the parts of speech when set before them in a sentence.

"If I were to build a house, I would take especial care that it should have a good and solid foundation."

Of these words, four sorts are varied to express our thoughts with greater exactness: they are *nouns*, *pronouns*, *adjectives*, and *verbs*; and the remaining five sorts, *articles*, *adverbs*, *conjunctions*, *prepositions*, and *interjections*, never undergo any alteration.

The learner will do well to make himself competent to point out one part of speech before he proceeds to another, and expert in distinguishing all, before he attempts to understand the inflections of any. For this purpose, let him take any printed book that may be handy (the History of Whittington and his Cat will suit his purpose as well as any other), and having copied a few sentences, let him read over attentively the rule given, and mark under every word which he thinks belongs to the part of speech treated of. Practice will soon make him expert at this, as it will also at declining, comparing, and conjugating nouns, pronouns, adjectives, and verbs, and in the formation of sentences and selection of phrases—the ultimate purpose of grammar.

OF THE ARTICLE.

An Article is a word set before a noun, to express its signification more clearly; as, *a* man, that is, some man; *the* man, that is, some particular man.

This part of speech takes its name from the Latin word *articulus*, which means a joint, or small part. The articles are easily distinguished, as we have but three in the language: they are *a*, *an*, and *the*. The two first of these, as will be seen by-and-bye, are used for the same purpose; for which reason grammarians consider them the same word, and say we have but *two* articles.

Example.

"I have *a* hundred times wished that one could resign life as *an* officer resigns his commission; for I would not take in any poor ignorant wretch by selling out. Lately I was *a* sixpenny private, and, God knows, *a* miserable soldier enough; now I march to *the* campaign *a* starving cadet, *a* little more conspicuously wretched."

N.B. In printed examples, the words under which lines should be drawn are printed in Italics.

As the articles are so easily distinguished, before I take my leave for the present, I shall speak of the Noun; and then leave such of your readers as are desirous of availing themselves of the rules thrown down for their improvement to the prosecution of their studies.

OF THE NOUN.

Nouns, which are also called Substantives, are words which express the names of persons, places, and things. Thus, George is a noun, because it is the name of a person; *grove* is a noun, because it is the name of a place; and *pen* is a noun, because it is the name of a thing. The word thing, however, has many meanings. The objects that we see are called things; and whatever we can think about may be called a thing. We may think about *pleasure* and *pain*—about *pride*, *misery*, *truth*, *falsehood*, *friendship*, and *cruelty*, and many other things which we cannot see; yet these are all things, and the words which express them are consequently nouns.

The word noun comes from the Latin, *nomen*, which means a name.

There are about 20,500 nouns, or names, in the English language.

It was customary, a few years ago, to begin every noun with a capital letter; but this practice has been discontinued.

Example.

Oh, *woman!* lovely *woman!* *Nature* made you
To temper *man*; we had been *brutes* without you.
Angels are painted fair to look like you.
There's in you all that we believe of *heaven*—
Amazing *brightness*, *purity*, and *truth*,
Eternal *joy*, and everlasting *love!*

Should the learner at any time doubt the correctness of his exercise, after having performed it, he may refer to any English Dictionary, where he will find marked after every word the part of speech to which it belongs.

I am, Sir,
Yours obediently,
WM. SMITH.

Castle-House Academy, Guildford,
Jan. 1, 1825.

PERPETUAL MOTION.

Sir,—This question, which has been kept in motion perpetually for such a number of centuries, is designed to have no rest in the Mechanics' Magazine, and I think it is right to keep it going, as the discussion it excites is both amusing and instructive. Few have tried to catch the Proteus without being made wiser by the attempt; in fact, it teaches its votaries, in a palpable manner, those immutable laws and principles in nature which form the foundation on which the sciences of mechanics, hydrostatics, &c. are erected. I do not, however, allude to those who spend the most precious of their hours in searching after it: they, poor simple souls! have not brains to see either principle or law —they may *dream*, but cannot *think*.

I perfectly agree with your able Correspondent, T. B., that *inert* matter can never be formed into a self-moving machine, vary it as you will. Metals, stone, wood, fluids, will all sink into a state of rest, unless a something *keeps* them in motion, which *something* it is in vain to look for in the mere *strength* and *weight* of the material. It is impossible to manœuvre Nature, and trick her out of her rites, or gain a sudden advantage over her; and what we gain at one point we must lose at another. Those who think otherwise are merely found to have lost their judgments in the complexity of their machines. The project of Alpha, in a late Number, is of this description: his *penetration* must have been *drowned* in his water bellows, for the cause of its failure is absolutely without a veil to cover its nakedness! W. B.'s "manumotive carriage" may be classed among the perpetuals, and it certainly is the *youngest* one that has yet made its appearance. He gains a power with his screw, but loses twice as much by his wheels; and, by-the-bye, his ideas about these wheels are *backside foremost*, for he is so miserably mistaken as to imagine he is gaining, by their combination, the tremendous power that is running directly against him. He also rates the power of his screw much too high, and seems to forget that it is always in proportion to the thickness of the threads and the length of the lever by which it is moved.

J. O.'s "method of forming a vacuum without steam or piston," has a proof of its fallacy on the face of it; for the tube marked *b* shows that the mercury will rise to its barometrical height, and yet he thinks it will run out of one adjoining vessel into another, leaving a vacuum behind it, notwithstanding they are nearly upon the same level!

Of all the attempts at perpetual motion I have yet seen, that of Philo-Montis, founded on the assumption that light bodies will ascend through a suspended column of water, is the cleverest, that is, the cause of its failure is more hidden than in any of the others. I studied some time before I could see its main defect, and Mr. Bell, who has had a hard shaking with it, has not pointed it out at all. It seems to be this:—Each ball, on entering the tube to ascend, will *displace* and *leave behind it* a quantity of water equal to *its bulk*; consequently (allowing there is no loss occasioned by the opening and shutting of the valves) the water will sink in the tube on the ascent of every ball. *If* it had remained stationary, the thing would have been complete; but, alas! the little word *if* generally hops in to thwart our brightest schemes.

Having done with this long *palaver*, your readers will perhaps be surprised to find me a believer in the existence of a perpetual motion after all, or rather in the possibility of discovering it: such, however, is the case. Those who condemn the notion altogether, seem to have taken but a very confined view of the subject. What they say about mere matter is right enough; but they seem to forget that there are other *active agents* in nature, which possess wonderful powers, that have nothing to do with either bulk, weight, or form. Such are electricity, magnetic attraction, capillary attraction, and the irregular pressure of the

atmosphere. The powers of electricity are great, and indeed it seems to be the *primum mobile* that gives life and motion to the animated part of the creation. Dr. Franklin shows us how to give a circular coated plate, revolving on an axle, sufficient power to roast a chicken, merely by once changing it. Could not a plate of this kind be made to turn a small electrical apparatus, so situated as to keep the charge in the plate always at its maximum? The whole might be kept dry by having it enclosed in a glass-case.

It has often been attempted to give motion to a wheel by the power of a loadstone, but hitherto without effect; no substance in nature being found to have the power, by interposition, of cutting off its attractive property. Still I think it should be further investigated. Is a small piece of steel, in the form of a wedge, as strongly attracted at the smaller end as at the thicker? and would not 20 or 30 pieces of steel, of that form, placed round the circumference of a circle, the point of one towards the head of the other, cause a magnet, placed in the centre, to revolve in the direction in which their points lie? I think, perhaps not; but still such experiments should be tried.

In capillary attraction we have a power that at once raises fluids above their level. It is this which carries the oil up the wick of a lamp as fast as the flame consumes it. Water and other fluids rise through cotton even quicker than oil, and he who can contrive to *collect them* as they arrive at the top, will discover a perpetual motion. Would not water run constantly through a syphon, one leg of which was made of a collection of capillary tubes, and the other in the usual way? or would the water above and below the tubes neutralise and destroy heir power?

I now come to the pressure of the atmosphere, a thing easily understood, and I think I have caught her at last! Make a cast-iron barometrical tube, with a top sufficiently large to contain 2 cwt. of mercury, invert it in a bason large enough to contain 2 or 3 cwts. more, and let a piece of iron of 10 or 12 stones weight float on the mercury in this bason, so as to rise and fall along with it at every change of the weather. We have here both motion and power. The *motion*, indeed, will sometimes *stand still*, but then it can easily be regulated, and made a constant quantity in the machinery to be attached. I have no doubt but clocks, &c. may be made to derive their *chiming principle* from a contrivance of this nature.

If any of your readers should find the above hints *useful* (God save the mark!), I hope they will have candour enough so acknowledge the obligation.

I am, Sir,

Your obliged servant,

J. WELCH.

Newton, near Alnwick.

BORING.

SIR,—In the last Part of your Magazine which I have received, I saw a reply to Mr. J. Welch, by M. Monnom, concerning Boring the Earth. I have a considerable depth to bore immediately, and as a part of it will be very hard rock, if M. Monnom can assist me by his scientific advice, now is his time. I am well acquainted with the method of boring, that is, with the way miners, in general do it—so is Mr. J. Welch, I perceive; I also understand how to drill iron, rock, &c. in the common way, by applying weight or pressure to the top end of the shaft of the drill whilst it is turned round. Now, I would thank M. Monnom to say, how I can apply weight to the top of a set of boring-rods, when the hole is 300, or even 30 feet deep. I conceive, that weight applied to the top end of the rods would stop the boring at once, for the rods would bend in the hole, and if twisted with great force, must break. Miners often turn the rods about to keep the hole round; but their weight alone, by turning only, would not sink the hole (in some kind of rocks) one inch

in a mouth. M. Monnom must remember, that his shaft for drilling iron, &c., is only two or three feet long; boring-rods are often two or three hundred feet long. A word or two, by the way, respecting Wm. Spencer's plan for chambering the bottom of a hole in a rock, after it has been bored with a common tool, by a joint at the foot of the bore. I sometimes see a hundred borer bits broken by boring one inch (in an inch-and-half hole in width), by striking the borer with a heavy hammer. Where would Wm. Spencer's joint, three inches long and tipped with steel, be, when such rough usage as the above is necessary to bore a perpendicular hole? *I think, off at the joint*, and left at the bottom of the hole.

I remain, Sir,
Your obedient servant,
A South Wales Under-ground Land-Drainer.

VIATOR'S PERPETUAL PUMP.

Sir,—I see your Magazine constantly, but not regularly, or immediately after publication, otherwise I should have replied before to my antagonist's denial of the possibility of the operation of the Perpetual Pump, which forms the frontispiece of your 93d Number. I should have thought it honourable in Messrs. Montis, jun. and N. H., in Number 100, to have inquired where the machine was in actual operation, before they presumed to tarnish your pages by giving the lie direct to an absolute fact. As they have scorned to ask the question, I shall not deign to give them the answer, or have any thing to do with them. But to you, Sir, who have acted so different and liberal a part, I return thanks for your impartiality, and beg leave again to state, that it was not an invention of *mine*. Had it been such, I should have sent it to the Society of Arts, Manufactures, and Commerce, before the commencement of your useful Magazine; but it was sent, as stated at the time, only as a *communication*, for the utility and amusement of your various readers, to whom the subject might be interesting, and as an addition to your valuable work, by which thousands of others, with myself, have been so agreeably entertained.

I again beg leave to repeat, that I saw it actually at work, as it had been for years, and now is, if the works are not worn out by time, and that it fully answered the purpose. It was shown me as a curiosity by a fellow-traveller, who, years before, had witnessed it as he passed that road, as we then saw it, in actual operation.

While examining the machine at work, I could not but admire it for its extreme simplicity, and, as such, contrasted its superiority to one invented by Mr. Sargeant, which I had some years before seen in the Transactions of the Society of Arts, Manufactures, and Commerce, and which is described in your first volume, principally in its having no valve, and working with a less fall of water; the pert assertion, therefore, of Montis, junior, respecting a valve ("but this Viator does not seem to have thought of"), is of an equal stamp and value with his former assertions, for I was thinking of it all the while, and extolling its utility on that very account.

The valve, therefore, which he recommends and describes in your 114th Number, is not worth a rush. I compare Montis junior's assertions to those of the Indian, who, on having a windmill recommended and figured to him, replied, it was impossible such a machine could work, but proposed the motion of a branch of a great tree in the wind, *only he had not tried the experiment*, but he was certain it would be superior.

I acknowledge my thanks to R. Crusoe, for vindicating the possibility of the perpetual pump; and I think T. N. P., in Number 114, should have done the same.

I remain, Sir,
Your obliged servant,
Viator.

Kimbolton.

BORING.

SIR,—As an account of the different Strata in the Coal-fields of Northumberland cannot but be interesting to your geological readers, I make free to send you a catalogue of those met with in sinking St. Anthon's Colliery (one of the deepest mines in the kingdom), near Newcastle, which strata extend, with little variation, over all that district. It is extracted from Bailey and Culley's Report to the Board of Agriculture; a valuable work, but which, it is probable, few of your Correspondents have read, it being almost exclusively devoted to agriculture.

		yds.	ft.	in.
	Soil and Clay	10	0	0
	Brown Post	24	0	0
1	Coal	0	0	6
	Blue Metal Stone	5	2	0
	White Girdles	4	1	0
2	Coal	0	0	8
	White and Grey Post	12	0	0
	Soft Blue Metal Stone	10	0	0
3	Coal	0	0	6
	White Post Girdles	6	0	0
	Whin	3	1	6
	Strong White Post	6	1	0
4	Coal	0	1	0
	Soft Blue Hill	3	2	0
	Soft Girdles mixed with Whin	7	2	0
5	Coal	0	0	6
	Blue and Black Stone	7	1	0
6	Coal	0	0	8
	Strong White Post	3	0	0
	Grey Metal Stone	3	1	0
7	Coal	0	0	8
	Grey Post mixed with Whin	8	1	0
	Grey Girdles	6	1	0
	Blue and Black Stone	4	2	0
8	Coal	0	1	0
	Grey Metal Stone	4	0	0
	Strong White Post	12	0	0
	Black Metal Stone with hard Girdles	6	0	0
9	High Main Coal	2	0	0
	Grey Metal	9	0	0
	Post Girdles	0	2	0
	Blue Metal	1	1	0
	Girdles	0	1	2
	Blue Metal Stone	10	0	0
	Post	0	1	0
	Blue Metal Stone	6	0	0
	Whin and Blue Metal	0	1	6
	Strong White Post	7	0	0
	Brown Post with Water	0	0	7
	Blue Metal Stone with Grey Girdles	4	2	0
10	Coal	1	0	0
	Blue Metal Stone	6	0	3

		yds	ft.	in.
	White Post	1	1	0
11	Coal	0	0	6
	Strong Grey Metal with Post Girdles	4	0	6
	Strong White Post	2	1	0
	Whin	0	1	0
	Blue Metal Stone	2	2	7
	Grey Metal Stone with Post Girdles	5	1	5
	Blue Metal Stone with Whin Girdles	3	1	3
12	Coal	0	1	6
	Blue-grey Metal	1	0	8
	White Post	4	0	7
	White Post mixed with Whin	4	0	0
	White Post	2	2	0
	Dark Blue Metal and Coal	0	2	2
	Grey Metal Stone and Girdles	4	2	0
	White Post mixed with Whin	6	0	7
	Whin	0	1	0
	White Post mixed with Whin	2	0	6
13	Coal	1	0	3
	Dark Grey Metal Stone	1	0	6
	Grey Metal and Whin Girdles	3	1	10
	Grey Metal and Girdles	3	0	0
	White Post	1	0	0
14	Coal	1	0	2
	Blue and Grey Metal	1	1	0
5	Coal	0	0	9
	Blue and Grey Metal	4	0	0
	White Post mixed with Whin	1	1	6
	Grey Metal	2	0	6
	Grey Metal and Girdles	2	0	9
16	Low Main Coal	2	0	6
	Total	270	1	8

As M. Mennom wishes to know what sort of stones Northumberland produces, I give him the above as a very fair specimen. I am only sorry he was offended at my observations on his new method of boring, for I would be loth to quarrel with any person about such trifles as stones and holes, especially with any ingenious person like Mr. M. I have more than once been gratified by perusing his communications, and I even allow the machine found fault with to be a clever contrivance, notwithstanding its inutility. But it was his *drilling* principle I condemned, and it pains me to find him still sceptical on the subject; for I assure him his ideas are quite as erroneous as his apparatus is useless; and that he may just as well prefer a carpenter's plane for the purpose of dressing freestone, as attempt to cut hard siliceous minerals in the way he proposes. He says, I am "unacquainted with the nature of friction;" but does he not set friction at defiance? If he cannot see how, the edge of his tool will tell him. Lastly, he is wrong in saying, a machine calculated to jolt or beat the rods would be unworthy a place in the Mechanics' Magazine; for he may depend upon it, that in such a contrivance lies our only chance of improving the art of boring.

I am, Sir, your obedient servant,

Newton, near Alnwick. J. WELCH.

ALGEBRA.

SIR,—As many of your readers are, no doubt, studying Rowbotham and Nicholson's Algebra, it may perhaps interest some of them to know that the 29th Example of Quadratic Equations may be solved, as a simple equation, as follows:—

Page 144, Example 29.

What two numbers are those whose sum is to the greater as 11 to 7, the difference of their squares being 132?

Let x = greater, and y = less;

$$\text{then } x + y : x :: 11 : 7,$$

$$\text{and } x^2 - y^2 = 132.$$

From the 1st equation, $7x + 7y = 11x$

$$\therefore x = \frac{7y}{4}.$$

$$\text{By substitution, } \frac{49y^2}{16} - y^2 = 132,$$

$$\text{or } 49y^2 - 16y^2 = 2112,$$

$$\therefore y^2 = \frac{2112}{33} = 64;$$

$$\text{and } y = \pm 8;$$

$$\text{and } x = \frac{7y}{4} = 14.$$

I would likewise propose to any beginner, who studies neatness and elegance in his working, to solve the following question without multiplication.

Divide 44 into two such parts that three times the greater may exceed seven times the less by 15.

I remain, Sir,
Your most obedient servant,
BIJA GANNITA.

CONDENSER.

SIR,—As a lover of justice, I am sure you will not refuse to insert my claim to the prior (though not original) invention of the Condenser, described in No. 118, which only reached me yesterday. The fact is, that I had one made above two years ago by an ingenious young brazier of this town, named Mellard, and I have had it in almost constant use ever since, till nearly the present time. It was of copper, but is now worn out, and was cut to pieces the other day.

I found it so effectual that I have had fourteen or fifteen in use, which are made of sheet lead, about eighteen inches deep, and one foot inner diameter.

This mode of condensation is not, however, an original English invention, for it will be found to have been used in Sweden long since, and is described in the Number of the Repertory of Arts for August, 1804.

I remain, Sir,
Your obedient servant,
WM. CASLON,
Chemical Manufacturer.

Rugely, near Litchfield, Jan. 2, 1826.

RISE OF MERCURY IN THE TORRICELLIAN TUBE.

SIR,—A Correspondent, in a late Number of your work, requests some information on the subject of the Rise of Mercury in the Torricellian Tube. In Cates's Lectures on Hydrostatics and Pneumatics, an experiment is mentioned in which the mercury rises to the height of 70 or 75 degrees. The account of it is very brief: all that is said being that it was made in the open air, with mercury purged of air.

I am, Sir,
Yours respectfully,
F— H—.

Percy-street, St. Pancras, Dec. 22, 1825.

PHENOMENON OF THE SUN DRAWING WATER.

SIR,—In answer to Tyro, I wish to state that the seeming radiation of the sun's rays is merely an optical deception. They are all *parallel*, and only *appear* to *diverge* from the relative situations of the sun and the observer. It would be difficult to explain this properly without an engraving; but if Tyro will peruse any treatise on perspective, he will easily comprehend how it is. The sun is the *point of sight*, and its rays *parallel lines* that seem to run into that point. J. WELCH.

HINTS TO CLOCKMAKERS.

Sir,—I beg leave to offer, through the medium of your valuable work, an improvement which I propose in the striking part of Clocks, particularly those of the larger kind, as Church or Turret Clocks. It is this. On hearing a town clock strike without being aware of it, the first sound is often lost, and, as the hammer strikes uniformly, there is no telling whether the first was an actual sound of the bell or not. It generally happens that the listener always knows the time to *two* hours, and is as generally dubious of the one he listens to count. Now, should the clock be made to strike in pairs instead of uniform regular strokes equidistant in time from each other, as at present, I think the advantage would soon be too manifest ever to return to the old method. An odd one at the last would always give the odd hours from one to eleven inclusive, and the even, or pairs, the even hours from two to twelve inclusive; so that, if the ear caught the last two blows or sounds, or often one alone, the hour would be determined precisely without the preceding. Ships' bells always strike in this manner, and give the half-hours by pairs. Another improvement, I think, would be for all public clocks to strike once, a minute before the hour is up, or half a minute, as a warning sound; for not only is the first, but often the second stroke lost, by the ear not being sufficiently warned of the time of striking. The navy officers seem to be perfectly attentive to the advantages of this case; for, in their signal-guns in fogs and night service, they always fire a warning gun, as it is termed; so that the persons to be informed of the proper signal may be expecting when to listen more particularly to the exact number of guns one minute afterwards, otherwise the greatest mistakes would naturally follow.

Perhaps many of your readers have listened when one has said, hark! the clock strikes! and the company have differently counted; some thinking it struck ten, others eleven, others saying it must be ten or eleven, but could not clearly make out which. In the night, or in riding out, or in wet weather when abroad, the benefits of this method would be more apparent.

I hope some maker will be induced to try it, and some of your scientific readers will express their opinions more fully on this subject.

I remain, Sir,

Your well-wisher,

A Traveller.

SOLID AND HOLLOW CYLINDERS.

Sir,—F. O. M's conclusions, in Number 124, p. 191, of the Mechanics' Magazine, on Solid and Hollow Cylinders, may be correct, for ought *I*, or *seven-tenths* of your readers, know of his method of explanation. I am far from objecting to any thing because I do not understand it; but having a great objection to my own ignorance, I have, from the beginning, applied to the Mechanics' Magazine for knowledge, and most gratefully acknowledge I have not applied in vain. I grant, also, that the mathematical and geometrical knowledge which is displayed by many of your learned Correspondents, evinces the importance both of such knowledge and of the "*vehicle*" by which it is conveyed to the public. It tends to establish a confidence in the reader, when he perceives the writer to be learned, although he does not comprehend the *mode* of information: I, therefore, assume the pen in behalf of myself and numerous brethren, who are uninitiated in the profound secrets of mathematics, begging F. O. M. will be so favourable to us, as to tell us the difference and preference between solid and hollow cylinders. The postscript which follows his learned, but (*to us*) unintelligible statement, *is not radically conclusive*. The hollowness of *animal cylinders*, if such term be applicable to bones, does not appear to

the natural philosopher to be so constructed for the purpose of the greatest strength, but for the purpose of uniting strength enough, along with the indispensable animal moisture proper for the economy of the whole; for the further explanation of which, I must refer your readers to those whose particular profession it is to give it. *Lectures on Anatomy* will bear out the little I have advanced: I think it important to acknowledge that it be good.

I am, Sir,

Your obedient servant,

OYRTRIO.

January 9th, 1826.

P.S. OF RAZORS.—I wish you would put "Razors and Strops" into *cold water now,* and congeal that subject. The *teeth of razors,* indeed! A microscope and a fiddlestick's end to such arguers! Get a good razor, and keep it sharp with a good hone, and as hard a strop as crocus martis, impressed into buckskin leather, with sweet oil or grease, will make it; and use the water hot or cold, as best suits your choice. My strop is ten years old, and as hard as my razor nearly; and in shaving myself I am quite "*the barber,*" employing only three minutes daily.

A word more to the poorer class of mechanics on the economy of self-shaving. A good razor will cost 2*s.* 6*d.*; a strop can be made as above—if not, you must pay 3*s.* for one; this is, in all, 5*s.* 6*d.*—the cost of materials for a man's life-time, if the articles be good, and he takes proper care of them. Going to a barber's twice a week is at least twopence a week, which is above eight shillings a-year; so that in ten years he pays four pounds for what he might get, soap and all, for ten shillings.

NEW WEIGHTS AND MEASURES.

Synoptical View of the New Weights and Measures, according to Act of Parliament, 1824, showing how to reduce the Old into the New, et vice versa.

Calculated by Professor Wallace, Anderson's College, Glasgow.

I. The Imperial Standard Yard, 3 feet; the foot, 12 inches; the pole, 5½ yds.; the furlong, 40 poles; the mile, 8 fur. or 1760 yds. The English chain of 100 links, 22 yds. or 66 ft.; the link, 7.92 inch. The modern Scots ell, 37 inch.; the m. Sc. fall, 18.5 ft.; the m. Sc. chain of 100 links, 74 ft.; the link, 8.88 inch.; 36 m. Sc. ells, 37 yds.; 33 m. Sc. falls, 37 poles; 33 m. Sc. chains, 37 Eng. chains. The ancient Scots ell, 37.2 inch.; the anc. fall, 18.6 ft.; the anc. Sc. chain of 100 links, 74.4 ft.; the link, 8.928 inch.; 30 anc. Sc. ells, 31 yds.; 55 anc. falls, 62 poles; 55 anc. Sc. chains, 62 Eng. chains.

II. The Imperial Standard Acre, 4 roods; the rood, 40 sq. poles; the sq. pole, 30.25 sq. yds. The acre, 4840 sq. yds.; the Eng. sq. chain of 10,000 sq. links, 484 sq. yds.; 10 square chains, 1 acre. The m. Scots sq. fall, 342.25 sq. ft.; the m. Sc. rood, 13690 sq. ft.; the m. Sc. acre, 54760 sq. ft.; the m. Sc. sq. chain of 10,000 sq. links, 5476 sq. ft.; 1296 m. Sc. sq. ells, 1369 sq. yds.; 1089 m. Sc. sq. falls, 1369 sq. poles; 1089 m. Sc. roods, 1369 Eng. roods; 1089 m. Sc. acres, 1369 Eng. acres; 1089 sq. links, 1369 Eng. links; 79547.1 m. Sc. links, 1 Eng. acre. The anc. Scots sq. fall, 345.96 sq. ft.; the anc. Sc. rood, 13838.4 sq.

ft.; the anc. Sc. acre, 55353.6 sq. ft.; the anc. Sc. sq. chain of 10,000 links, 5535.36 sq. ft.; 900 anc. Sc. sq. ells, 961 sq. yds.; 3025 anc. Sc. falls, 3844 sq. poles; 3025 anc. Sc. roods, 3844 Eng. roods; 3025 anc. Sc. acres, 3844 Eng. acres; 3025 sq. links, 3844 Eng. links; 78694.6868, anc. Sc. links, 1 Eng. acre.

III. The Imperial Standard Cubic Yard, 27 cubic feet; the cubic foot, 1728 cubic inches. A cubic foot of distilled water at 62 deg. weighs exactly 997.136969 ounces Avoirdupois; and at the maximum density, 999.277 ounces Avoird.

IV. The Imperial Standard Troy Pound, 5760 grains, or 12 oz.; the oz., 20 dwts.; the dwt., 24 grs. A cubic inch of distilled water at 62 deg. therm. bar. 30 in. weighs 252.458 grs.; and at the maximum density, 253 grs.

V. The Imperial Standard Avoirdupois Pound, 7000 grs. or 16 oz.; 1 lb. Av., 1-10th of the weight of the new Imper. stand. gallon of dis. water at 62 deg. 175 Troy oz., 192 Av. oz.; 175 Troy lbs., 144 Av. lbs. The standard Scots Troy or Dutch lb., 7620 grs.; 350 standard Dutch lbs., 381 Av. lbs. The common Dutch lb., 17½ Av. oz.; 32 common Dutch lbs., 35 Av. lbs. The Tron lb., 23½ Av. oz.; 32 Tron lbs., 47 Av. lbs. The Glasgow Tron lb., 22½ Av. oz.; 32 Gl. Tron lbs., 45 Av. lbs.; but 5 Tron stones, 1 cwt. Av. The Edinburgh, &c. Tron lb., 22 Av. oz.; 8 Edin. Tron lbs., 11 Av. lbs. The Ayr, &c. Tron lb., 24 Av. oz.; 2 Ayr lbs., 3 Av. lbs. The country Tron lb., 23 Av. oz.; 16 country Tron lbs., 23 Av. lbs.

VI. The New Imperial Standard Gallon, 10 lbs. Avoir. of distilled water at 62 deg. therm. bar. 30 in., or 277.274 cubic inch. The gill, 5 oz. Av. of water; the pint, 1 lb. 4 oz.; the quart, 2 lb. 8 oz.; the peck, 20 lbs.; the bushel, 80 lbs., or 2218.192 cub. in.; the quarter of corn, 640 lbs. The old wine gallon, 5-6ths of a new gallon nearly, or 6 old wine galls.; 5 new galls., with a loss of about 1-37th per cent in the old, or 37 in 118637; 135500 new gallons, 138637 old wine gallons exactly. The new gallon, 59-60ths of an old ale and beer gallon nearly, or 60 new galls.; 59 old ale and beer galls., with a loss of about 1-106th per cent. in the new, or 13 in 138650; 141000 new galls., 138637 old ale and beer galls. exactly. The old Eng. corn gallon, 32-33ds of a new gallon nearly, or 33 old dry galls.; 32 new galls., 33 old bushels; 32 new bushels, with a loss of about 1-37th per cent. in the old, or 37 in 138637; 134400 new gallons or bushels, 138637 old dry gallons or bushels exactly. The old standard Scots pint, 22-59ths of a new gallon nearly, or 22 new galls., 59 st. Scots pints nearly, with a loss of about 1-75th per cent. in the new, or 202 in 1525209; 51702 new gallons, 138637 st. Scots pints exactly. The stand. Scots wheat firlot, 105-106ths of a new bushel nearly, or 105 new bushels, 106 st. Scots fir., with a loss of about 1-317th per cent. in the new, or 35 in 1109131; 2197335 new bush., 2218192 st. Sc. wheat firlots exactly. The new bushel, 92-133ds of the standard Scots barley firlot nearly, or 133 new bush.; 92 st. Scots barley firlots, with a loss of about 1-27th per cent. on the old, or 994 in 2634103; 801381 new bush., 554548 standard Scots barley firlots exactly.

VII. The Imperial Standard Heaped Bushel, 80 lbs. Avoir. of water as above; 3 bushels, 1 sack; 12 sacks, 1 chaldron. The bushel is a cylinder of 19½ inches in diameter, and heaped in the form of a cone to the height of six inches.

NEW POWER LOOM.

We extract, from the *Macclesfield Herald*, the following account of a new Power Loom, invented by an ingenious Frenchman; but must previously observe that, several months ago, we were informed by an intelligent silk-manufacturer of this metropolis, that he had invented, and was about to take out a patent for, a Loom, the powers of which, as

described to us, were nearly similar to that of the one here announced.

"M. Augustin Coront, of Lyons, has just invented an admirable machine, by which a single workman can conduct six rotatory looms, and weave silk, cotton, flax, hemp, and wool, into plain or figured stuffs, with a celerity and perfection hitherto unknown. This skilful mechanic has conceived the idea of two looms, which, by their combinations and the adaptation of two pieces, form a third. The first has already been used in the fabrication of crape, of seven-eighths taffetas, of three-quarters calicoes; the second, in making figured stuffs; and the third, set up as a five-fourth machine, two pieces of half-ell wide, each divided by a separate shuttle. All the accessories are applicable to these looms, and are set in motion by the hand, by alternately pushing the clapper, which is on wheels, and works horizontally. It receives its motion from a pulley, with a twisted leather strap, and two springs placed at each side of the loom. It is capable of being applied to an infinite variety of purposes. When it is wished to make a strong stuff, such as ticking or thick-grained cloth, the clapper strikes the wool twice each time it passes. In proportion as it is wished that the stuff should be open or close, slight or strong, the clapper strikes slightly or heavily, slowly or quickly, and the precise strength is controlled by a regulator. A hand-screw and a small mallet suffice to operate these changes. The shuttle, placed in boxes, which it does not quit except by the impulse of the workman, passes in the chain from 80 to 110 times in a minute, from the time the machine is set in motion.

"Another advantage is, that the shuttle has a twofold operation, of a nature hitherto totally unknown, so that it can be varied without trouble or delay, according to the unequal strength of the zones and the stuff; and notwithstanding the extreme velocity of both clapper and shuttle, the loom can be stopped at will without injury. While the parts stop which serve to fabricate one of the pieces in a loom arranged for 6-4, those of the second stop also. This is an inconvenience which M. Augustin Coront will in time be enabled to obviate, by making each piece of mechanism of a texture independent of the other; but these short intervals are made up for by the rapidity of the simultaneous execution of two pieces. This is nothing compared to the time lost by the workmen in common looms in disentangling and tying the threads.

"The application of this invention to the fabrication of muslins and tissues of flax, cotton, and hemp, proves that it is as favourable to the health of the workmen, as it is to the interests of commerce. In fact, the excessive fineness of its parts, each wheel being perfect, will admit of the employment of flax, hemp, and cotton thread quite dry, and it will consequently be no longer necessary to work them in low and damp situations, for the purpose of softening them. The workmen, in quitting the manufactories, which might almost be called caverns, where they are interred alive, will no longer labour under influences which stint their growth, and subject them to asthmatic and scrofulous affections. They ought to be as grateful to M. Augustin Coront for his invention, as the manufacturers of needles are to Mr. George Prior, who, in 1809, invented a very simple apparatus, composed of a variety of bellows, which blow away from the mould the particles of free-stone and steel which fly off in the process of cleaning, and which, before this invention, from their rotatory motion, flew into the eyes, nostrils, and mouths of the workmen, and were the cause of serious disorders. While observing upon the injurious action of the small particles which escape in the process of certain manipulations, we may, perhaps, be allowed to direct the attention of the scientific to the best means to be employed for the prevention of the injurious effects which arise from the silk-dust produced in the cutting of shawls."

INQUIRY.

NO. 178.—TAKING IMPRESSIONS FROM LETTER-PRESS.

SIR,—I should feel particularly obliged to any of my brother subscribers, who could suggest a method of taking *a perfect Copy of common Letter-press Printing*, by pressure or otherwise, without injury to the type or paper from which it is taken. I have made several trials with tissue-paper, but without success.

I remain, Sir,

Your most obedient servant,

M— D—.

——, near Maldon, Essex.

ANSWERS TO INQUIRY.

NO. 172.—BREWING.

First Answer.

SIR,—A "Novice" in brewing is informed that, in the large public breweries, the coppers have domed tops or close covers, with a condensing apparatus, the use of which is chiefly to save time and fuel, as it must be evident that a copper thus constructed must be brought to boil much sooner than an open one. Another advantage is, that the aroma or essential oil of the hop is thus prevented from flying off with the steam or vapour. This mode of boiling does not, however, add to the strength of the beer, but rather diminishes it, by preventing the escape of the aqueous vapour; and the wort not being in a state of fermentation, no alcohol or spirituous matter is formed, and consequently cannot be evaporated. One desideratum in boiling worts is to diminish their quantity, and thus to increase their strength. Wort fermented in close vessels will lose less of its alcohol or spirit than in open ones; and some Frenchmen have lately got a patent for fermenting beer in this manner, which may answer for large concerns, where a saving of two or three per cent. is an object, but the beer has not the flavour of good *old-fashioned home-brewed*; and I will back my old *Granny*, with her palate for a saccharometer, and her thumb for a thermometer, against either Goding or Charrington, bearing in mind that she brews all to drink, and they to sell, for it is too well known that many publicans must take what the brewer pleases to send them.

I remain, Sir,

Your obedient servant,

JOHN BARLEYCORN.

January 1st, 1826.

Second Answer.

SIR,—The question of your Correspondent is founded on an erroneous supposition. No portion of the strength of Beer passes off in the vapour. Your scientific readers will not need this information, but the error is pretty general among mere observers; and it is easily accounted for, when we consider how much the boiling of wort and the distillation of spirits are alike in appearance. In both cases the liquors, when boiling, give out vapour, and every one sees that the vapour given out in the *still* contains the spirit; and it is naturally enough concluded, that there is spirit likewise in the vapour arising from boiling wort.

I once held the notion myself, that the boiling of the wort must certainly decrease the strength of the beer. When I lived at home with my friends, we brewed our own beer and ale; and Richard, being a handy sort of a chap, had all the business intrusted to his hands. It was then that this vapourish notion, or notion of the vapour, first entered my head. I saw the process of distillation, and thinks I, directly, I have been boiling and stirring, and stirring and boiling, to a pretty purpose. What gallons of spirits I must have sent into the air at every boiling! I thought that I had made a grand discovery. The next thing was, an experiment to prove it.

Thinks I, I'll plan it, some how or other, to catch the spirit, and the matter will be settled. When the next strong beer went to the boiler, I had every thing prepared. I contrived to get half a glass full of the condensed vapour; I first applied it to the olfactory apparatus. The nose and glass approached each other very carefully, the former expecting a sudden attack on his very sensitive feelings, but no such attack was made, and disappointment ensued. Well, thought I, this does not *smell* much like spirits; but nothing like a trial on another organ. I put some on my tongue, and rolled it over the palate, but all to no purpose, save to confirm the disappointment. I found that I had pure distilled water, and nothing more. But I could not then account for it, why my wort, in boiling, should only give out *water*, and the distillers' wort give out spirit. Since that time I have obtained a little knowledge of the science of chemistry, and the cause is quite evident; in short, I am surprised that I should ever have expected otherwise.

The cause is this:—The wort for beer is boiled previous to fermentation; the distillers' liquor is boiled after fermentation. In the wort, the spirit is held in the saccharine matter; after fermentation, the spirit is free, and, if put in the still, will be the first to pass over.

My custom was, always to run a few pails more of wort than I wanted, and to continue boiling it till I had but a sufficient quantity of liquor remaining.

Thus you see the fact stands opposed to the supposition of "A Novice." The vapour lost in boiling does not lessen, but increases the strength of beer. The more vapour goes off, the stronger will it be.

An intelligent Correspondent, in a late Number, has given a clear description of a good process for brewing beer and ale on a small scale, and which is well worthy the attention of every one who attempts at home-brewing. You have not inserted a more useful article in the Magazine. The greater number of home-brewers manage their dealings with malt and hops in a sad way.

I trust that "A Novice" will be satisfied that a "condensing apparatus" is not required. If he wants strength, let him add *malt;* if he wants quantity, let him add *water*.

I am, Sir,
Yours respectfully,
R— H—.

NOTICES TO CORRESPONDENTS.

We have to thank the Office-bearers of most of the Mechanics' Institutions throughout the kingdom, for their prompt compliance with our request for an official return of the state of their respective Establishments at Michaelmas last; but as there are still a few from whom we have had no communication, we shall defer the publication of our General Abstract for one month from this date, in the hope that, by that time, we shall have no case of omission to regret. Let every Member of a Mechanics' Institution only make it his business to see that an account of its establishment and present condition has been forwarded to us, and the materials will be complete for one of the most interesting and important tables of results ever published.

Communications received from—W. Evance—T. Hewk—A Friend—P. P. P. —T. J. W.—A First Subscriber—Deoud —Philo-Steam—R. L.—Mr. Purdo—W. Hxx.—E. S. W.—Live and Let Live—A Fire Fly—Dr. Davidson—A Student—D.

Parts 31 and 32 will be published on Wednesday, February 1st, price One Shilling each.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

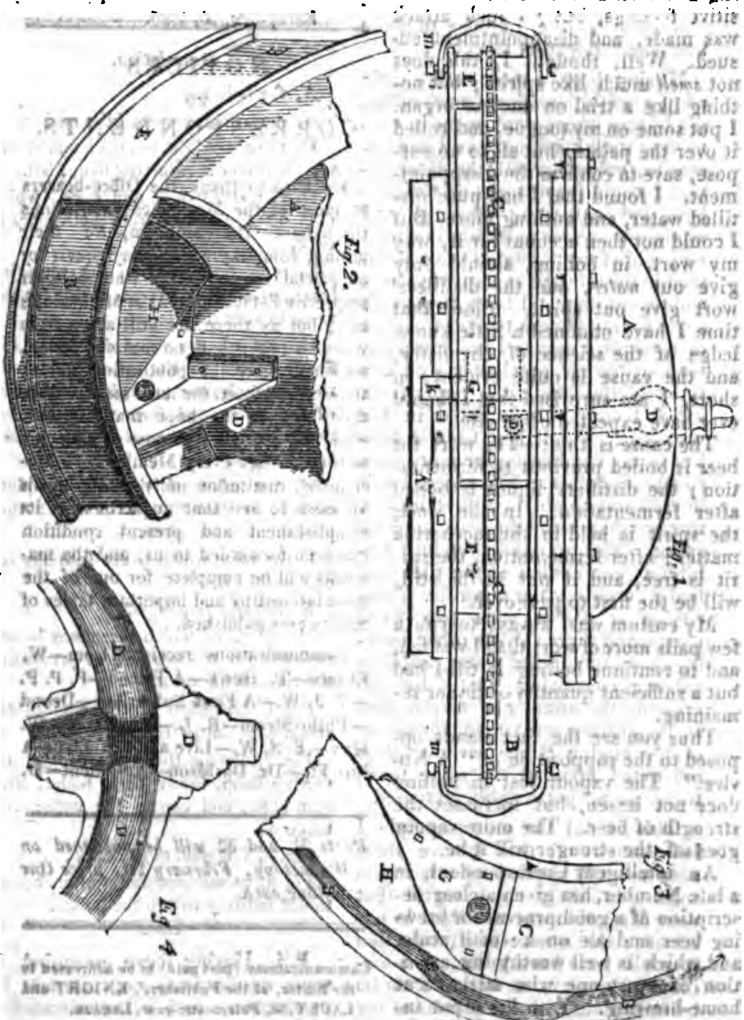
Printed by *Mills, Jowett,* and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 126.] SATURDAY, FEBRUARY 4, 1826. [Price 3d.

ROTATORY STEAM-ENGINE.



ROTATORY STEAM-ENGINE.

(To the Editor of the Mechanics' Magazine.)

Sir,—Having this spring obtained the two first volumes of your most valuable and interesting Magazine, I was so much struck with the description of Mr. Rider's Rotatory Steam Engine, that I have been unable to resist the impulse to make this communication to you.

Having been a most enthusiastic admirer of the beauties of mechanism, my leisure hours were spent in examining such machinery as I had access to, collecting all the information I could from works on the subject, and in making drawings and models of such as particularly struck me, whilst my thoughts were occupied in the attempt to improve some, and invent new. I have turned to some of my papers to find the plan of a rotatory engine I had invented, without having previously seen any thing of the kind: the paper from which I copy this is dated in the year 1812, and it had been a subject of my rumination for more than two years before. The object I had in view was to obtain a first mover, that would occupy the least possible space. The prefixed drawings exhibit a general view of the plan as I find it, omitting the minutiæ. This engine is drawn with two fixed plates, and three valves; other drawings have three fixed plates, and four valves; conceiving that, by increasing the number of *valves*, that is, the surface acted upon, the power of the engine (since several valves are acted upon at the same time) would be proportionably increased.

This is not the only principle I had thought of, that I have since seen usefully applied by other persons. Infinitely do I regret that your Magazine was not then in existence; the source of gratification it would have been to me, as a medium of inquiry, as well as from its being replete with the objects of my amusement, is not to be described. Soon after the date of this paper, the cares of life occupied my thoughts, and my hobbies were thrown into oblivion, being born, perhaps unluckily for myself, a useless being, instead of a blacksmith. With admiration of the result of your labours,

I remain, Sir,

Your constant reader,

J. S——.

Bath, Dec. 10, 1825.

Description.

A, the boiler.

B, the working-part of the engine.

C, the cogged rim to attach machinery to, fixed on the revolving hoop, BB.

D, the steam-pipe and cock, which cuts off the steam from both pipes at once.

E, projecting parts of the revolving hoop, to admit of a recess inside for the valve to shut in.

G, part of the fixed division-plate, firmly bolted to the upper and under rings, which rings are bolted to the side of the boiler, and form the plates between which the revolving hoop and valves work.

H, the edge of the division-plate curved, to shut the valves whilst they pass the division-plate.

I, the valve which shuts into the recess within E.

K, the eduction-pipe.

M, vices, of which there may be any number, for the purpose of preventing the rings flying open.

Fig. 1, Elevation of the engine—the steam-pipe dotted through.

Fig. 2, Perspective view of the revolving-hoop, lower ring, boiler, division plate, and valve; the upper ring taken off.

Fig. 3, The plan of the same.

Fig. 4, Steam-pipe and stop-cock, contained entirely within the boiler.

P.S. Having been occupied in some experiments on Silk and its production, and being dissatisfied with the caterpillars I had obtained, thinking them a degenerate race, am

I proposing a question too remote from the subjects of your consideration, in asking where I might be able to obtain half a dozen eggs of the most approved kind of silkworm?

CHERBOURG BREAKWATER.

(*Continued from page* 213.)

The failure of the cones, and the breaking out of the Revolution, put an entire stop, for some time, to all operations at Cherbourg. The attention, however, of the National Assembly was speedily called to what they considered to be an object of great national importance. In 1791, they directed their Committee for the Marine to make out a detailed report of the operations that had already been carried on. On this report being given in by M. de Curt, in the name of the Committee, it was read and approved by the Assembly, and funds to a certain extent decreed, to complete the undertaking on a new plan proposed by M. de Cessart. The principal feature of this plan was that of casing over the surface of the dyke as it then stood with large blocks of stone; and to carry the height of the breakwater along the whole of its extent, so far above the high water-mark of spring-tides, as to render it capable of receiving batteries on the summit, at the middle, and at the two extremities.

The slope of the side next to the roadstead was found on examination to sustain itself unaltered at an angle of 45 degrees, but the slope on the side next to the sea, whose base was three for one of height, had given way to the depth of fourteen feet below the low water-mark; and the materials being composed of small stones, were washed away, and had formed themselves into a prolonged slope of one foot only in height for ten feet of base, which was therefore concluded to be the natural slope made by the sea when acting upon a shingly shore—a conclusion, however, too vague to be correct, as the slope occasioned by the action of the sea must depend on the nature of the materials against which it acts, and the force and direction of the acting power. A sandy beach, for instance, has invariably the most gradual slope, gravel the next, shingles the next, and large masses of rock or stone, the most precipitous. At the present time, the stones of the breakwater, by constant friction, have worn away the sharp angles, and it has been found that the base on the side next to the sea is on the average fully eleven for one of perpendicular height.

It was proposed, therefore, to cover the side with a coating of stone 12 feet thick, to consist of blocks of 12, 15, 20, and 30 cubic feet, or from one to two tons each, which casing was to be carried to the height of 12 feet above the high water-mark of the highest spring-tides; the size of the stones to increase towards the summit, so as to be capable of resisting the percussion of the waves, which is there the strongest. It was calculated that this covering, of 12 feet thick on both sides, would require for each toise in length 70 cubic toises of stone, and that the whole length of the dyke would consequently require 136,500 cubic toises, which, by deducting for the vacant spaces between the stones, would be reduced to 113,750 cubic toises of stone, or about one million and a half of tons. It was farther calculated, that the expense of quarrying, the transport to the quays, the loading, conveyance, discharging machinery, together with the Commissioners, clerks, &c., would cost for each cubic toise deposited on the dyke the sum of 55 livres, which for 113,750 cubic toises, would amount to 6,256,250 livres, and, adding for contingencies 600,000 livres, the total estimate amounted to 6,856,250 livres.

It was calculated, that 34,090 toises might be deposited in one year, reckoning only six working months, or 5682 toises per month; or that 487 superficial toises of the dyke might be covered in one season, and the whole completed in four years. Very little progress, however, had been made at the com-

mencement of the war in 1803. At that period the centre of the dyke only had been brought above the high water-mark, in which was placed a battery and a small garrison of soldiers, the whole of which were swept away by a heavy sea, occasioned by a tremendous gale of wind in the year 1809, when all the buildings which had been erected on this part of the breakwater, the men, women, and children, which composed the garrison, together with several workmen, were washed away; at the same time, two sloops of war in the roadstead were driven on shore, and dashed in pieces. This disaster was such as might have been expected. The effect of sinking large stones upon the small ones, already rounded by constant attrition, could not be otherwise; the latter acting as so many rollers, carried out the former even beyond the extremity of the base, to which the breakwater had naturally been brought by the action of the sea.

At present, small spots only are visible above the surface of the sea at low water of spring-tides, and nowhere such spots exceed three feet in height; the intermediate spaces are from three to fifteen feet below the surface; and, taking the average, the whole dyke, from one end to the other, may be about four feet below the surface of low water at the spring-tides. Near the middle, however, there is about 100 yards where the height rises to 18 or 20 feet above high water, but it exhibits only a shapeless mass of ruins. In one spot a large heap of stones has been accumulated, as if to try how much weight might safely be trusted upon it, before the attempt be made to rebuild the fort. The largest of the stones in this mass may be about four tons, and they descend to the size of 200 or 300 pounds.

Of the remainder of the dyke, very few parts are visible at low water; and, at this moment, the greater part is four feet below the surface of low water; it is sufficiently high, however, to break the force of the waves, and to make the port of Cherbourg a safe anchorage, in some winds, for about forty sail of the line.

On the renewal of the war, after the rupture of the treaty of Amiens, Bonaparte began to bestow a greater share of attention on the navy of France; and though, for a time, the unparalleled victory of Trafalgar checked his efforts, it did not induce him to abandon them. His plans were vast, and, at the period of his fall, were in rapid progress towards their completion. He had determined on a fleet of 200 sail of the line, and the noble port of Antwerp gave him every facility for ship-building. For the better security in forming a junction of his two great fleets of Brest and Antwerp, Cherbourg now became more valuable, as a convenient port of retreat in case of accident; but it had no dock-yard, nor means of giving to a ship a large refit or repair. He might have thought, too, as we believe most of our naval officers do, that a fleet of ships, riding at anchor behind the breakwater, are easily attackable by fire-ships, as the same wind which carries a vessel in at one entrance will carry her out at the other, and the course would lie directly through the centre of the fleet at anchor. Besides, it might be possible, in certain winds, under the lee of the centre part of the breakwater, to bombard a fleet at anchor in the roadstead within it.

He determined, therefore, to establish a large dock-yard at Cherbourg, not merely for repairing, but also for the construction of the largest class of ships of war; to dig a bason that should contain fifty or sixty sail of the line; to construct dry docks and slips for building and repairing, and to make it a naval port of the first rank. In 1813, this basin was completed at an expense, as Bonaparte is said to have asserted when on board the Northumberland, and which has since been confirmed, of 3,000,000*l.* sterling. A wet dock of the same magnitude, communicating with it, was then commenced, and is now in progress.

(To be concluded in our next.)

APPARATUS FOR FRACTURED LIMBS.

Sir,—As I was accidentally turning over the leaves of an American work, called the Medical Recorder, published in Philadelphia, I happened to light upon the following letter, addressed to the editor by General Henry Dearborn. This letter, which will be found in the 31st Number of this work, appears to me of so much importance that I send it to you, thinking, that if you can find a place for it in your valuable Miscellany, it may meet the eyes of some persons who may be suffering the miseries of a long confinement in bed for the cure of a fracture of the leg. A friend of mine has suffered very severely from this cause, while, it appears, had he known of the apparatus mentioned in this letter, he might have been up, and able to superintend his affairs, which became much deranged during the period he was confined to his bed. I now remember seeing, in some work, or paper, that Mr. Wallack, the actor, was cured of a fracture of the leg by the assistance of this apparatus in about forty days, without any confinement from exercise, after he had been confined, under the usual treatment, seven months, but was not aware, till now, that the apparatus is applicable to all fractures of the lower limbs. As this apparatus seems to be but little known, I think you would be doing a great piece of service to those who are confined with a fracture of the lower limbs, by giving it an early insertion in your very useful publication.

I am, Sir,
Your constant reader,
A Friend to Improvement.

"Boston, June 15th, 1825.

"Before I received Amesbury's apparatus, I had been confined to my bed between three and four weeks, and had not been able to be removed or set up but with great care and difficulty, and then but seldom. I was fortunate in finding an excellent surgeon in Hartford, Doctor Morgan, whose great experience, skill, and success, has justly rendered him celebrated; and my recovery was rapid under his care, beyond my expectations: still, from being large and heavy, it was fatiguing and dangerous to move on or from my bed, until the new splints were applied, when I was taken from it with facility, without the risk of injury, and without fatigue or pain; and by the aid of crutches, the second day, I walked about my chamber, and into the dining-room; on the third day, and after, I could get out of and into bed without assistance, and ride in a carriage—sit up all the day, with the exception of a short nap after dinner; and on the eighth day I set out on my journey home. I rode with perfect ease the whole distance of one hundred and twenty miles in three days and a half.

"I consider Mr. Amesbury's apparatus an invaluable invention, and that in all fractures of the lower limbs, I am confident surgeons and patients will find it, on trial, so beneficial and comfortable, that there can be but one opinion in relation to its utility.

"I am satisfied it has facilitated my recovery, and enabled me to walk and ride four or five weeks sooner than I otherwise could have done, with safety and ease.

"I can perceive no difficulty in a patient's walking and riding, as soon as the swelling and fever have abated. No surgeon should be without it; and those who are so unfortunate as to fracture a limb, will be astonished at the aid which will be derived from its application.

"I deem myself most fortunate in being able to obtain the splints.

* * * * * * *

"Henry Dearborn."

[The description of this apparatus is still very defective. We shall be glad to receive further particulars.—Edit.]

MR. CECIL'S GAS-VACUUM ENGINE.

Sir,—I have just met with a paragraph in your ivth volume, p. 376, stating, "in justice to Mr. Cecil," that the writer saw his very ingenious Gas Engine at work in the

year 1822. He only does Mr. Cecil *half* justice; I was present when the machine was exhibited *in action* at a *meeting* of the Cambridge Philosophical Society in 1820 or early in 1821; and, to my knowledge, it was in construction during the year 1818.

I am, Sir,
Your obedient servant,
H— T—.

NAVAL ARCHITECTURE.

SIR,—The question of doubt respecting the sailing of the Hector and the Orion, may, perhaps, be explained by supposing that the alterations made in both vessels at night lowered their centres of gravity; and, if so, the alterations in the morning would, of course, raise them. Now, suppose it requisite for any ship to sail at its quickest rate, its centre of gravity ought to be in a certain situation, neither too high nor too low: it would appear that, in the Hector, it was too high in the day, and in the Orion, too low in the night. It will not do, I should suppose, to imagine that the Orion sailed as well in the night as in the day, or the Hector as well in the day as in the night; but that, with the same alteration, the rate of the one was diminished and the rate of the other increased. The increased or diminished rates might or might not be equal.

Much has been said on the best form for a ship for sailing, but I have not heard that any one has been constructed agreeable to the form of the solid of least resistance, as given by W. Emerson; or, if that form has ever been tried, whether there are any objections to it.

I am, Sir,
Your obedient servant,
H— G—.

January 15th, 1826.

SIR,—In p. 223, No. 226, of the Mech. Mag., Monad very ingeniously says, "if I am not mistaken, the *right curve* for the formation of the hull of a ship is to be found *in every fish that swims.*" Now, as ships are appointed to move *on the surface* of the water, and as little as possible *in it*—and a fish's element being *in* and entirely *under water*, and whose *curve* is connected with *flexibility* equally necessary to the infinity of a fish's motions, I cannot see the analogy between a ship and a fish near enough to allow Monad's remark to pass unnoticed, lest those of your young readers, who too often (from necessity) take information on trust, and may not be gifted or qualified to weigh comparisons in the scale of natural reasoning; nor need I endeavour to advance any improvement on Monad's hint, *knowing* that the subject of Naval Architecture is in superior hands to that of

A THAMES FLOUNDER.

SIR,—I am glad to find the pages of the Mechanics' Magazine more occupied than usual with details relating to Naval Architecture. It is impossible but that intelligent shipwrights and mariners must have made many observations on the comparative behaviour of vessels of different construction, and even of the same vessel under different circumstances. To encourage men of these descriptions to recollect and remit for publication the facts which have occurred under their own experience, I would take the liberty to submit the consideration, that it is only by comparing together a multiplicity of such details that we can hope to arrive at any system of fixed and determinate rules applicable to the science. Like many other sciences, theory in *this* can only be established as the result of repeated experiment; and because some who are willing to communicate the facts they have observed may yet be at a loss for a proper method of doing it, I subjoin (as a form for arranging details) what I conceive will serve as a sufficient guide to direct the theorist in his conclusions upon each particular case. The observations upon a single vessel should recite,

1st. The particulars of length aloft, breadth, and depth.

2nd. Length of keel and its depth.

3rd. Rake of the stern-post, ditto of the stern, dimensions of rudder.

4th. Extreme breadth at water-line, rising of the midship-floor athwart-ships, position of main-frame.

5th. Departure from straight-lines of the water-line and rising-line, at every yard or two yards of distance.

6th. Draught of water a-head and a-stern.

7th. Measure of the fulness at bow and quarter.

8th. Position and length of masts and bowsprit, and the quantity of canvas set on each of them, distinguishing between square and stay-sails, and without regard to studding-sails, except in particular cases.

9th. The behaviour of the vessel in different cases, as lying-to or at anchor, sailing close-hauled, or going large in different weathers, her angle of lee-way in easy weather, with any other particulars in the manœuvring which the intelligent seaman may think worthy of notice.

Whenever the observer intends to note down any particular circumstance, he should be careful to remark the kind and quantity of sail upon each mast; and, when sailing in company, he should compare his own vessel with others, and mark the points wherein she excels or falls short of them.

I place below a scheme for arranging such observations in a tabular form; and am, Sir,

Your most obedient servant,

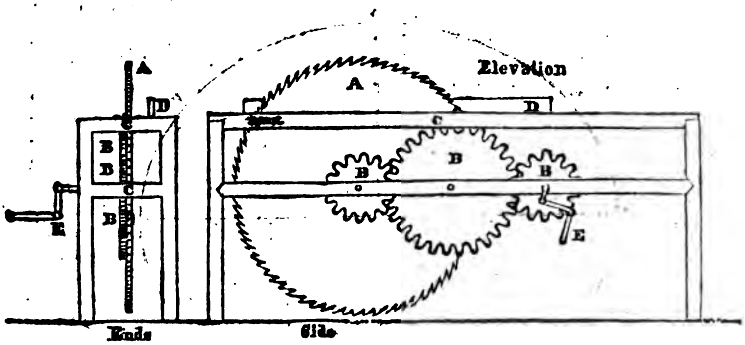
MONAD.

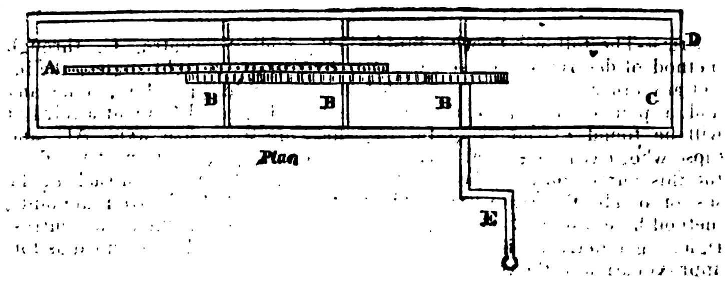
Length aloft.	Keel.	Breadth aloft.	Breadth at Water Line.	Rake.	Rake of Stern Post.	Rudder.	Rudder.
Depth in feet	Draught of Water.	Fulness of Bow.	Fulness of Quarter.	Rake of Stern, inclusive of Yard.	Inches in a Yard.	Dimensions aloft.	Dimensions below.
						feet.	feet.
						feet surface.	

Departure of Water-line. inches in a yard.	Departure of Rising-line. inches in a yard.	Rising of Main-floor. inches in a foot.

Mainmast.	Height in feet.	Position.	Canvas in square sails.	Canvas in stay-sails.
Foremast.	Ditto.	Ditto.	Ditto.	Ditto.
Mizen.	Ditto.	Ditto.	Ditto.	Ditto.
Bowsprit.	Length.	Rake.	Length of Jib-boom.	Ditto.

MR. SHUTTLEWORTH'S HAND-SAW MILLS.





SIR,—It has often occurred to me, that the principle of Saw-Mills might be applied to the use of those workmen who have not capital for the erection of steam-engines, by employing manual force. This induced me to construct the machine represented by the prefixed drawings. It may be made of any size; and one to answer the purpose of a large saw-pit may be turned and worked by two men, who by it will do twice the work, with much less labour, and in half the time, that they can at present. Small ones may be contrived, to take up less room than a carpenter's bench; and a man or boy would saw all the usual work to a nicety, impracticable to the best workman with a common instrument; and cabinet-makers might cut their own veneers, without the trouble, and with less expense, attending saw-mills.

I am, Sir,

Yours respectfully,

M. H. SHUTTLEWORTH.

Tottenham-Green.

Description.

A, the circular saw.

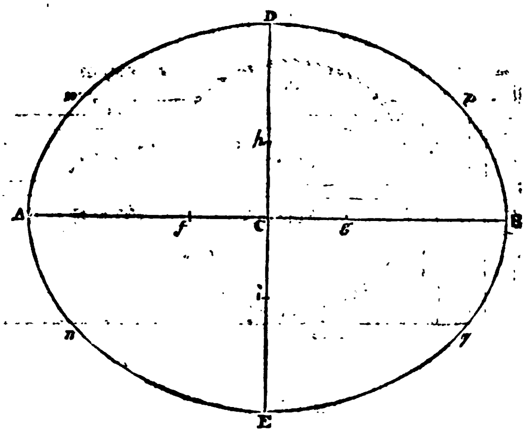
BBB, three wheels, turned by the winch, and working the saw A.

C, the oak or iron framing to the machine.

D, the direction-board for guiding the wood.

The same letters refer to all the figures.

A NEW METHOD OF DESCRIBING ELLIPSES.



SIR,—The following very simple method of describing Ellipses, without any other auxiliary than a rule and a pair of drawing-compasses, will be found extremely useful to those who, having frequent occasion for this curve, may not be in possession of elliptic compasses. The method here proposed, although not rigidly geometrical, is so close an approximation to the truth, that, in practice, it will probably be found to produce a more accurate ellipse than can even be effected by the elliptic compasses, in all cases where the conjugate axis is not less than three-quarters of the transverse axis, which is as great an eccentricity as is required for any ordinary purpose. A peculiar advantage of this method is, that it is effected without any false or auxiliary lines. The general theorem resolves itself into two cases; in the first case, the transverse axis is given, and the conjugate axis optional; in the second case, both axes are given.

CASE I.

To describe an ellipse; the transverse axis being given, and the conjugate axis optional.

Rule.—Draw the transverse axis, AB, find its centre, C, through which draw, at right angles, the indefinite right line, DE; take any extent, C*f*, equal to about a third of the semi-transverse axis, AC, and set off that extent from the centre, C, in both directions on each of the axes; you will then have four points, *f*, *g*, *h*, *i*, about which, as centres, the curve is to be described as follows:—

Place one foot of the compasses on *f*, open the compasses until the other foot falls on A, and with that extent, as a radius, describe a quadrant of a circle, *mn*, as nearly as can be estimated by the eye; in a similar manner, with *g* as a centre, describe another quadrant, *pq*; then remove the compasses so as to place one foot on *i*, open the compasses until the other foot falls on *m*, the remotest point in the quadrant, *mn* (which must be in a line with *i f*), and with that radius describe the quadrant, *mp*; also, with the same radius, and *h* as a centre, describe the quadrant *nq*, and the ellipse will be completed.

Note.—Should the ellipse thus produced be more eccentric than wished, one equally perfect, of less eccentricity, may be obtained by

taking the extent, Cf, equal to a quarter, instead of a third, of AC.

CASE II.

To describe an Ellipse, the transverse and conjugate axis being given.

Rule.—Having drawn the two axes at right angles with each other, and intersecting in their common centre, multiply the semiconjugate axis by 100, and divide by the semitransverse; find the quotient in the first column of the annexed table, take out the number opposite thereto in the second column, multiply it by the semitransverse axis, and divide by 100; you will then have the extent, Cf, which is to be set off from C to *f*, *g*, *h*, *i*. Place one foot of the compasses on *f*, in the transverse axis, open the compasses until the other foot falls on A, the nearest extremity of that axis, and with this radius describe the quadrant, *mn*; in like manner, with the centre, *g*, describe the quadrant, *pq*; then place one foot of the compasses on *i*, in the conjugate axis, open the compasses until the other foot falls on D, the remotest extremity of that axis, and with this radius describe a quadrant, *mp* (which must meet the two quadrants already drawn); repeat the operation on the other extremity of the conjugate axis, and the ellipse will be completed.

Remark.—If the semitransverse axis be considered equal to 100, the numbers in the first column of the annexed table express the length of the semiconjugate axis, and those in the second column the distance of the four central points from the centre of the ellipse; but if the semitransverse axis be considered equal to unity, all the numbers in the table become decimal fractions. The reason of the numbers in the first column commencing with 75, is, that the rule being only an approximation, fails in accuracy when the conjugate axis is less than three-quarters of the transverse.

If the two axes of the ellipse are given geometrically, instead of numerically, all the foregoing operation may be performed more readily without any computation, by making the semitransverse axis a parallel distance between 10 and 10, on the line of equal parts on the sector, then applying the semiconjugate axis to the same scale, you will have its length, which being sought in the table, you will at once have the corresponding extent, Cf, to be taken from the same scale.

A

TABLE

For Constructing Ellipses.

Semi-Conj. Axis.	Dist. of Centre.	Semi-Conj. Axis.	Dist. of Centre.
75	42	88	20
76	40	89	19
77	39	90	17
78	37	91	15
79	35	92	14
80	34	93	12
81	32	94	10
82	30	95	9
83	29	96	7
84	27	97	5
85	25	98	4
86	24	99	2
87	22	100	0

I remain, Sir,

Your obedient servant,

M. SMITH.

Commercial-road.

ON THE NECESSITY OF MECHANICS BEING TAUGHT MORE TRADES THAN ONE.

SIR,—In answer to your Correspondent who proposes that mechanics should learn more than one trade, I beg to quote the old saw—"The smith that is blacksmith and whitesmith too, maun gae shoe the goslings."—LACON.

Yours respectfully,

F. O. M.

BLOWING HOT AND COLD.

SIR,—Being at all times as willing to give (when in my power) as to receive information and explanation from your valuable miscellany, I will, with your permission, attempt to rectify T. M. B., Number 120, in his ideas of Blowing Hot and Cold, or at least propose mine for others to rectify, if they can, and in as friendly a manner.

I think, therefore, the breath from the human body is neither hot nor cold, but the mean or medium between; *i. e.* warm, or blood-warm, or 98 degrees of Fahrenheit, and, generally speaking, every thing above that degree of temperature may be termed *hot*, and every thing below termed *cold*. It must be observed, that when the caloric of any bodies, or different fluids, intermix, the nature of the less will always be annihilated or destroyed, and then assimilated with the greater body. A cold subject, say, for example, cold fingers, in a frosty morning, become cold by the greater quantity or body of still colder air which surrounds them; but being blown upon by the breath, will, if it is continued *long enough*, cause the subject so blown on to rise to the temperature of the breath, but not otherwise; whereas, the same current of breath blown on a spoonful of boiling water, will lower the temperature of the water till it reaches that of the breath, and will never be lower, so long as the breath continues to blow, but when that ceases the water will next partake of the degree of temperature of the air which surrounds it. Observe, however, that the agitation of the water's surface causing a ripple, greatly expedites the cooling of the water, as does also the air, which being of a lower temperature, would in a little time do it of itself. This will, perhaps, be better exemplified, if a bottle or basin of water, at blood heat, is put in a crust of ice (powdered), when it will soon congeal and become ice; but if the same basin is put into boiling water, it will finally, by contact or immersion, become of the temperature of the greater body it is immersed in. The *current* of the breath is only the motion or action of speedier contact; the effect would be the same if there was no current; *i. e.*, could the same quantity of breath be blown in a vessel, and the fingers be admitted into it without permitting any of the warm air to escape. Thus the small power of the lesser body is lost or mixed up in that of the greater. Connected with this rule, is the fact of the sun's rays putting out the fire; also, the fact of the sea being much warmer after a storm in winter than before, for the cold air of winter, acting only on the surface, the storm intermixes it with that immediately beneath; the caloric, therefore, of the surface, which is the smallest, is thus lost in that of the greater, and the result is naturally the consequence.

I remain, Sir,

A well-wisher to all scientific Inquirers, THURLEIGH.

WONDERS, ANCIENT AND MODERN.

Wonder is the effect of novelty upon ignorance. Perhaps it was from a fear of being thought to possess too much of the latter, that the ancients limited their "wonders" to seven—they are too well known to need enumeration—they were *birched* into us, in our *happier* days. The ignorance of the moderns is no Poyais land of imagination—it is real estate, not handed to them from their forefathers, but created by themselves, struck out of the ocean of Time, like an island from the sea. Their moral wonders are innumerable; let us take a few as a specimen.

That a set of scientific men should lay it down in axioms, that intemperance in eating and drinking creates disease, and anticipates old age; and that men, in the teeth of these, should indulge in excesses in both, and that the said scientific men should join them in the practice.

That while personal liberty is generally acknowledged as one of the

greatest blessings that man enjoys upon earth, thousands *create* habits which they know must eventually deprive them of it.

That while a love of sights exists so strongly in the mind of man, that he will neglect his business and impoverish his pocket to gratify it, while he shuts his eyes to the most splendid appearances that are offered to him *gratis*, and turns from a setting sun, to Punch or Bartholomew Fair.

That interdicts against any practice, whether from inspiration or mortal wisdom, generally produce it; as "Commit no nuisance," always leads you to the spot.

That men should look forward to being cherished and supported by their offspring, when "age trembles on their hands," and they feel that they should "lift a *lighter* spear," when a reference to their *own* conduct, as children, would prove the fallacy of such an expectation.

That men should be perpetually prying into the conduct and characters of their fellow-creatures, in which a thousand obstacles prevent their being successful, while they suffer their own conduct and character to remain unobserved, with the data ready made to their hands.

PHINTA.

WHY DOES A RAZOR CUT BETTER AFTER HAVING BEEN DIPPED IN HOT WATER?

SIR,—I have frequently seen this *cutting* question agitated in your pages, and in those of other periodicals; I have forborne to give an answer to it, daily expecting such a reply from some of your Correspondents as common sense would dictate to any thinking man, with a small portion of chemical knowledge.

Hair, horns, hoofs, and nails, are principally composed of hardened gelatine: now, gelatine possesses the property of becoming softer, or more easily divisible into parts, either by being soaked in hot water, or by caloric applied in any other way, but not in so great a degree in the latter case as in the former; it follows, therefore, that to produce a maximum of effect, the hair, horn, &c. should be as wet, and the cutting instrument as hot as possible, short of burning the animal substance.

If your readers wish an experiment to convince them that this is a property of gelatine, let them dip two fingers into warm water, and two others into cold; upon cutting the nail upon one of each with a cold knife, they will find that on the warm finger cut easier than that on the cold, and both of them easier than that on a dry one. If, now, the knife be warmed in any way, the effect will be more visible on all three. This is precisely what is done in shaving: lather is first applied, which can never continue hotter than 98°, because that is the temperature of the human body, and it is rapidly brought down to that by evaporation from its surface: the hair is not sufficiently softened by this heat for some persons' feelings, therefore they increase the heat of the razor to 150°; if they go much farther, their sensations tell them to stop. It is by no means *essential* that the razor should be dipped into water; heated mercury, or sand, would do as well, but we use water because its temperature is more equable; it is more common too than the one, and more convenient than either.

The old barber's fear of dipping his razor into hot water, surely showed that, though a shaver, he was *no cutter*. The heat of his pocket was not greater than that of his lather; his putting it there, therefore, neither did good nor harm; and his fears of altering the temper of his tool could not have been excited, had he known that, in tempering, it had already been exposed to a temperature of 480°, or thereabouts—168° higher than he was frightened at.

I hope I have clearly explained the cause of this effect, and your readers may probably think it more simple than that which calls in such properties of matter as the *solvent*

powers of water as *exercised upon hard steel*, or the *abrasion of electrical particles*.

I am, Sir,

Respectfully yours,

W— H—.

Bristol.

RUSSIAN MODE OF HOUSE-WARMING.

Sir,—I was some time ago accidentally in company with a gentleman who had arrived from St. Petersburgh, where, he says, the houses are warmed by a kind of iron flue or stove (perhaps of the shape of an oven), which is built into the walls of each room, and *consumes its own smoke*. These iron "fire-cupboards" are even with the wainscoting, reach from the floor to the ceiling, and are five or six feet wide, with a small iron door at which the fuel is put in, and another at the bottom, whence the cinders are taken out; and they are so painted as to form part of the wainscoting of the room, giving an equal heat to the atmosphere of the chamber, at the same time that there is no danger of the house catching fire from "shooting coals," or of dreadful accidents to women and children, whom we too often hear of being burnt to death in England.

I am not sure whether the iron doors are made to open inside the room, or at the back of the stove in some anti-room, or in the passages of the house—I am inclined to think the latter is the case.

If such is the plan by which the modern capital of Russia is warmed, and if I have rightly understood the subject, it appears to me highly desirable to have it universally adopted in London. But I have other reasons for recommending the adoption of smoke-consuming flue-stoves, besides the comfort in-doors, and the safety from fires and burnt children, viz.—there will be no occasion for chimnies, and the dangers attending their falling, in our boisterous climate; the atmosphere of the metropolis would, in half a century, become clear, pure, and wholsesome; and, by the same period, our sooty churches and public buildings, and our brown gloomy-looking streets, would be metamorphosed into light, airy, white edifices, giving a cheerful and noble aspect to a city which might then vie with any in the world.

I should like to know from any of your Correspondents acquainted with the subject, what objections there are to the adoption of the Russian flue-stoves which *consume their own smoke* (so different from the Dutch chaffing-dish or French urn, both of which fill the room with smoke, and endanger the burning of the house); and if I have not given the correct description of the said Russian stove, I shall feel very much obliged if any of your readers who have resided at St. Petersburgh will do it for me, and if you will allow it insertion, with this, in your valuable Magazine. I hope it will be acknowledged, that any invention which would consume the smoke of one hundred thousand fires, is of no trifling importance, when it does not militate against comfort or convenience in-doors, and would revolutionize an impure atmosphere, and restore the beauty of our numerous white, but now sooty public buildings.

All great manufactories, such as shot, gas, glass, sugar-baking, potteries, founderies, &c. would be much safer, and better situated, if they stood outside the metropolis, or along the banks of the Thames.

I am, Sir,

Your obedient servant,

T. J. M.

P.S. There are some people who, for the sake of an old English fire, will sit idle a whole evening, burning before and shivering behind, unable to work, read, write, or draw, on account of the cold, rather than give the preference to a room equally and comfortably heated every where by a flue; but had such people once experienced the luxury of a parlour in Russia (a far more rigorous climate than ours), according to my informant's account, I think they would change their mind.

BREWING.

[*See Inquiry, No. 172.*]

SIR,—If a "Novice, of Old Broad-street" will collect a little of his condensed vapour, he will find it perfectly pure water, without a particle of spirit in it: this will teach him that the only improvement in brewing attendant upon the adoption of his condensing cover, would be a small reduction in the size of his brewing copper and mash-tub, for if less water is allowed to fly off less may be originally put in; but this improvement would be more than counterbalanced by the increased strength of the wort left in the grains.

The "Novice's" friend's mode was open to the same objection, and also to a greater one, namely, an increased liability to turn sour; for the longer wort is kept at *a moderately elevated temperature*, the more certain is the advance of the acetous or vinegar fermentation, which takes place from about 90 to 98 degrees, whereas it should be the object of the brewer to keep his fermentation from 64 to 86 degrees, according to circumstances.

I know of no beverage so grateful, nor any one so nourishing, as beer, when taken in moderation, but I believe there is no household operation so frequently unsuccessful as brewing. This arises, perhaps, in a great measure, from its being generally intrusted to servants who have no science, and sometimes but little practice, and where they have had practice they are very prone to whims and prejudices, which are frequently handed down from one generation to another.

Your excellent work is not a proper place for a lengthened treatise on brewing; I will therefore detail, as shortly as I can, a system which a little chemical knowledge and a great deal of practice has laid down for me, and by means of which I am furnished with a clean and wholesome beverage, perfectly fine in about a week, no other materials being used than malt, hops, water, and yeast. My strong beer is generally as strong as 6 or 8 gallons to the bushel of malt; that to drink with meals 12 to the bushel; and table beer 20. Every brewer should use a thermometer; I make my own, and engrave against the degrees as follows:—

212 Boiling Water.
Mash $\left\{\begin{matrix}186\\177\end{matrix}\right.$ Old Malt.
Mash.. 168 New Malt.
Set Table.. 86 Beer.
Mild.... $\left\{\begin{matrix}76\\68\end{matrix}\right.$ Beer.
Old ...... 64 Beer.
Freezing .. 32 Water.

The five following axioms are laid down to my servants, as being all that are necessary in the process:—

1. Mash as hot as possible, so as not to scald or set the malt.
2. Boil till all the gluten is deposited.
3. Set the worts together as near as possible to the above temperatures.
4. Let the fermentation be as perfect as possible.
5. Get yeast that is not sour or stale.

When the malting season has but just commenced (October or November) malt is sometimes sent out very new, then the mashing temperature should be as low as 168 degrees; when malt is slack or damp, it may be as high as 186 degrees; but, where a person has no knowledge of those qualities, I should recommend them to take about 176 degrees; all water, added after, should be boiling. The gluten of the first wort is generally deposited by one hour's boiling, and the second by one hour and a half; the wort should be cooled to the proper temperature as quickly as possible, by exposure to the air. Old beer, of six or eight gallons, to keep twelve months, should have one pound of hops per bushel, and the setting temperature should be from 64 to 68 degrees, according to the heat of the air. Wort of twelve gallons to the bushel should have

half a pound of hops per bushel, and the setting temperature from 68 to 76 degrees: this may be tapped in a week, but is better if left a month. The setting temperature of table-beer may be as marked above, from 76 to 86 degrees. When the strong or middling beer has, by fermentation, advanced its temperature 10 degrees, it is fit to tun into the barrels; this will generally be the case when it has had sufficient depth in the kive tub (say 20 inches), in 12 to 16 hours; if the head of the kive is composed of large bladders, tun quickly; if of a fine bread-like appearance, leave it longer; if the tun is left too long the beer does not get fine so soon.

While the fermentation is going on in the cask, which should be rapid at first and decrease for two or three days at farthest, fill it up twice or three times a-day with clean wort, that is, that which has but little yeast in the bottom: the cask should be bunged when, upon blowing off the head, the beer under is free from bubbles.

I forgot to say that the yeast necessary is something more than one gallon to sixty: if too much is put in it will be thrown back again—it is not lost.

I remain, Sir,

Yours respectfully,

W— H—.

Bristol.

Sir,—Among many others, I feel particularly obliged to Experimentum Crucis, of Stratford-upon-Avon, for his communication on the subject of Brewing, inserted in No. 115, for November last; and, as that gentleman has expressed his further desire to be instrumental to the public good, should any one think his further communications likely to conduce to that end, I beg leave to assure him that I am certain many individuals will consider themselves under great obligations to him, and among them none more so than myself, by his detailing the remainder of his proceedings, the scale of gravity, and description of his hydrometer, &c., which appears to answer all the purposes of a saccharometer.

Having conducted my own family brewings (about six bushels each) for the last twenty-five years, I have often wished for an instrument to try the strengths of the worts, &c., having found, by experience, that my beer, though brewed every week exactly in the same manner, has often varied in quality, which must originate from the malt—a fact which shows the propriety of your Correspondent's method; but, from experience, I am led to believe that one hour and a half for each mashing is quite sufficient, and saves much time, which is an object. A neighbour of mine used to let his mashings stand three hours each; but, altering them at my suggestion, he assures me he now has better beer.

I am, Sir,

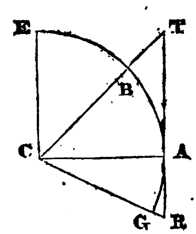
Your obedient servant,

A Constant Reader.

CASE IN TRIGONOMETRY.

Sir,—The proposition of which your Correspondent, Mr. Felix Ford, wishes for a simple demonstration, is thus demonstrated upon the principles of Plane Geometry, at p. 10 of "Dr. Gregory's Trigonometry," published in 1816.

"Prop.—The secant of any arc is equal to the sum of its tangent, and the tangent of half its complement.



"In the above diagram, where AB is the proposed arc, let the tangent TA be produced downwards

till TA + AB = CT, the secant. Then, since angle B is the complement of ACR, and of ∠ ATC (the perpendicular let fall from T upon the base CR, of the isosceles triangle CTR, evidently bisecting the vertical angle ATC), it follows that ACR = ½ ATC; that is, = ½ comp. ACT. But AB is the tangent of ACR, or of the arc AG, whence the proposition is manifest."

In the above, I have simply added the phrase between the parentheses for the sake of explication. The whole will thus, I hope, be rendered sufficiently obvious to any person who understands common geometry. No analytical demonstration that could be given would involve so few distinct principles as what is here quoted.

ACADEMICUS.

NORTHERN EXPEDITION.

Sir,—Having read Indicator's letter in your Magazine, No. 124, begging to be informed whether the bilge water was frozen in the Arctic ships, I have to acquaint you, for his information, that the carpenter of the Hecla states that the bilge water in that ship was invariably frozen during the winter season; and that it was a practice, before that event took place, to raise the pumps about three feet, and protect them against the severity of the cold with matting.

I am, Sir,
Your humble servant,
M— P—.

MR. BADNALL'S NEW SILK MACHINERY.

Sir,—In No. 119 of your valuable periodical you have copied from the *Leeds Independent*, an article entitled "Mr. Scott's New Silk Machinery," whereas the invention alluded to is that of Richard Badnall, jun. Esq. a banker, of Leek, Staffordshire, of whom Mr. Scott is an industrious workman. As agent of the patentee I feel it my duty to give you this information; but, were I not interested in such capacity, I should nevertheless think it incumbent upon me to point out any error in a publication so generally read as is the Mechanics' Magazine, which I might have it in my power to correct.

I am, Sir,
Your most obedient servant,
and constant reader,
Peter Harriss Abbott,
Agent to R. Badnall, Esq. 2, Walbrook Buildings.

[A correction of the error thus politely pointed out by our Correspondent, previously appeared in No. 122. We add this as being of superior authority.—Edit.]

PADDLE-WHEELS.

Sir,—Having noticed, in No. 121 of your useful publication, an ingenious plan of an Attorney's Clerk for propelling vessels with improved paddle-wheels, I beg leave to acquaint him, as well as your other readers, that I have seen an excellent model of such a plan (invented many years since) in the *Conservatoire des Arts*, in Paris.

In justice to our Gallic neighbours, as well as the probability that this piece of intelligence will prevent time and money being expended on an invention which I have no doubt is conceived to be original by the clever Attorney's Clerk, I trust you will find a spare corner in one of your Numbers to insert it.

I am, Sir,
Your obedient servant,
Neux.

Upper Berkeley-street, Jan. 13th, 1826.

NOTICES TO CORRESPONDENTS.

Aurum "On Learning more Trades than One," probably in our next.

Communications have been received from R. . . t—Mr. Dalin—Mr. Dowsbery—J. Long—Inquisitrice—F. S. F. H. —An Old Subscriber—S. B. Z.—Drift—W. Crosbie—Ironsides—W. M. J.—Lieut. H.—Montis, jun.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

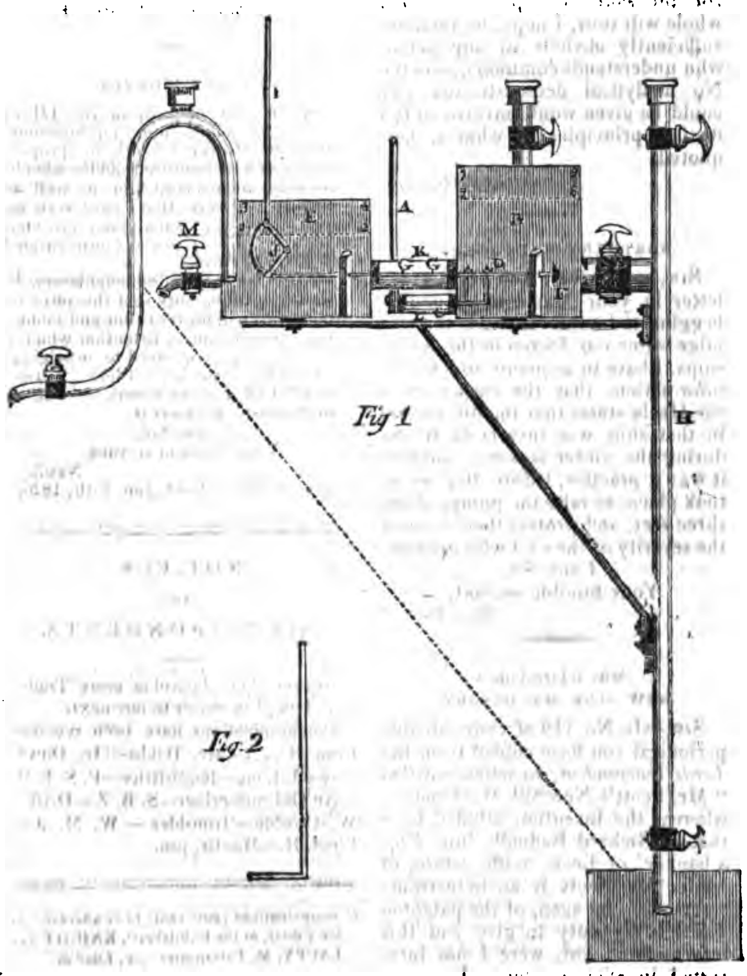
Printed by *Mills*, *Jowett*, and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 129.] SATURDAY, FEBRUARY 11, 1826. [Price 3d.

PLAN OF A VACUUM ENGINE.



VACUUM ENGINE.

SIR,—As you had the goodness to insert in your useful Publication a communication from me, dated October 1st, I trust you will pardon me for troubling you on the present occasion, for the purpose of correcting a material error in the plan proposed to your consideration. I ought to have considered, that the pressure of the atmosphere on the surface of the mercury in the small vessel would prevent the descent of the mercury in the large one. The prefixed sketch is submitted to your investigation, where, I think, you will perceive that the above-mentioned error is corrected by the pipe A, open at the top, connected to the large vessel, B, near the bottom. In the pipes L, there are two valves, CC, which are connected and work with the square sliding-bar, D. When the quantity of mercury that was contained in the space 1, 2, 3, 4, of the small vessel, E, has run out, the valve F being closed, and the valves CC and GG open, the pressure of the air on the open pipe, A, will force the mercury out of the large vessel, B, up to the level, or in equilibrium; 3, 4, and 5, 6, in both vessels, and the space 5, 6, 7, 8, in the vessel B, will be a vacuum, which cannot be destroyed by the air pressing on the pipe A, as the air cannot find a passage through the mercury. The tube H is here supposed to be 24 inches long from the upper cock to the bottom, being less by seven inches than the barometer tube, consequently there is no vacuum above the mercury in the tube; and seven inches, I presume, may be considered as considerably below the common barometic range. The cock M is a regulator, to convey into the reservoir below, by an inclined plane of glass, any extra quantity more than is required to turn the wheel and to overcome the friction, which certainly must be very considerable. The sliding bar, D, is worked by a vertical motion of the lever, I, by the circular-crank, J; the lever, I, could be worked by the large wheel, which is not represented in the prefixed sketch; the pipe A is attached to the pipe L at right angles, passing under the pipe K, as is represented in fig. 2.

Not wishing to interfere in the discussion of a subject that seems to be decried by many of your learned Correspondents, I have only briefly to observe, that the plan proposed does not, in my humble opinion, violate any established law of mechanics; even the favourite dogma, that what is gained in power is lost in time, remains undisturbed.

I am, Sir,
Yours respectfully,
JOHN ORHCARD.

42, Ashley-lane, Manchester.

N. B.—FLOUR MILLS.—I have seen the Mills (alluded to in one of your late Numbers) belonging to Messrs. Ellicotts and Co., near Baltimore, in the State of Maryland. The invention of the elevators, hopper-boy, &c. was claimed by the late Oliver Evans, of Philadelphia, but was disputed, and a suit was commenced in Baltimore County Court. Mr. Evans obtained a verdict in his favour, though it afterwards appeared that he was not the original inventor; as a plate in an old Magazine was produced, being the section of a mill in Germany, with elevators, &c. in operation many years before their introduction into America. Mr. Evans, no doubt, made some improvement or alteration, which he might easily do, to entitle him to a patent right in that country.

BORING.

SIR,—It so happens, that they are working limestone under ground at this place, where I have an opportunity of daily witnessing their operations, which are chiefly carried on by blasting. Mr. W. Spencer's idea seems to be a good one: gunpowder, confined in a chamber, as he proposes, would undoubtedly have a much greater effect in splitting the rock, than when put into a smooth unenlarged hole, as is the universal practice at present. But as it ap-

pears to me that some inconveniences are attached to his plan, for the further elucidation of the subject, I beg leave to ask him the following questions:—

Water is always used in boring the holes: how are the chambers to be dried out, for they must be dry before the gunpowder is put in? And what sort of an instrument must be used to bring out the paste or *sludge* formed by pounding the stone?

Seeing that even the common chisels are frequently broken, does Mr. S. think the small pointed piece sufficiently strong to withstand the blows of the hammer, or has it to be treated in a milder way?

Will the superior execution sufficiently compensate for the greater length of time required to form a hole of this description?

I am, Sir,
Yours respectfully,
J. Welch.

Newton, near Alnwick.

ALGEBRA.

Sir,—As the progress of most beginners in Algebra depends upon their success in the very earliest parts, since the taste for this study and the power of overcoming difficulties increase at every step, I have thought that the following observations on a popular treatise on the subject might not be unacceptable to some of your readers.

The first part of Messrs. Rowbotham and Nicholson's Algebra labours under the following defects:—

1st. The questions are not solved in either a concise or an elegant manner; for the object in such a work as this is, not to get an answer to a problem, which is the least important part, but to illustrate by short examples the easiest and most elegant methods of working, by avoiding multiplication, changing proportions, &c. The authors seem to forget that, although with very low numbers, it is immaterial whether you multiply or add, it is not always the case when their rules come to be applied in daily practice. And,

2ndly. The questions are thrown together with scarcely any attempt at classification or regularity. Instead of each problem rising gradually above the preceding one in difficulty, they appear to have been jumbled together without any plan, sometimes to the great joy of the learner, who, having just toiled through a long question, finds himself unexpectedly running through the two or three following examples without finding any obstacle to exercise either his memory or invention.

I will instance a few cases as proofs of my assertions.

Nicholson's Algebra, p. 70, Rule VI. ought to have stood thus:—"A proportion may be converted into an equation by making the product of the extremes equal to the product of the means."

This rule is moreover unintelligible to the learner, as the terms *extremes* and *means* have never been defined. Messrs. R. and N. would have much increased the value of their book by the addition of a chapter on Proportion; it would have likewise shown the learner that the correct method of working their second example (p. 70) is as follows:—

$$x : 16-x :: 3 : 5$$
$$16 : 16-2x :: 8 : 2$$
$$2 : 8-x :: 1 : 1$$
$$\therefore 2 = 8 - x, \text{ and } x = 6.$$

Page 74, Simple Equation, Ex. 16, line 12, ought to be thus worked:—

$$\text{or } 2a+v = \sqrt{4c^2+v^2}.$$

Squaring both sides, $4a^2+4av+v^2 = 4c^2+v^2$.

$$\text{Then } 4av = 4c^2-4a^2$$
$$\text{or } av = c^2-a^2,$$
$$\therefore v = \frac{c^2-a^2}{a} = \frac{c^2}{a} - a.$$

Of five questions of precisely the same nature, two are given under the head of Quadratic and three under that of Simple Equations—e. 9, p. 95,

Ex. v.; p. 101, Ex. xxi.; p. 102, Ex. xxiii.; then p. 136, Ex. ix.; p. 138, Ex. xii. Some of these are worked very clumsily, as p. 136, Ex. ix. which ought to have stood thus :—

$$x : y :: 3 : 4$$
$$x^2 + y^2 = 324900.$$

From the proportion $3y = 4x$ and $y = \frac{4x}{3}$.

Substituting this value in the Equation $x^2 + \frac{16x^2}{9} = 324900$,

or $25x^2 = 2924160$, and so on.

And p. 102, Ex. xxiii. of Simple Equations should be thus solved :—

$$x + y = 19$$
$$x^2 + y^2 = 95$$
$$x^2 - y^2, \text{ or } (x+y) \,.\, (x-y) = 95.$$

Then, from the 1st Equation, $19 (x-y) = 95$,

or $x - y = 5$.

So in page 101, Example xxi. $(x+y) \,.\, (x-y) = 32$,

then $16 (x-y) = 32$, or $x - y = 2$.

Page 138, 8th line from the bottom, for "By adding x^2," read "By adding x^3."

I conclude, from Rule v., page 69, that the authors intended to arrange Pure Quadratics as with Simple Equations, and that the instances to the contrary are oversights.

Page 145, Example xli. of Quadratic Equations may be solved without completing the square, as follows :—

$$\frac{x^2 + y^2}{5} = 9,$$

$$\text{and } \sqrt{y} = \sqrt{\frac{x}{2}}.$$

Squaring both sides of the second Equation, $y = \frac{x}{2}$,

then $2y = x$;

but, from the 1st Equation, $x^2 + y^2 = 45$.

Substituting the value of x, $4y^2 + y^2 = 45$,

$$\text{and } y^2 = 9,$$
$$\therefore y = \pm 3,$$
$$\text{then } x = 2y = 6.$$

Page 242, line 7, for "$4x^3 + 2x + 5$," read "$4x^3 + 3x^2 + 2x + 5$."

Page 243, line 15 from the bottom. This sentence is ungrammatical and unintelligible. By omitting the words which I have enclosed with brackets, some sense may be extracted from it.

"Products which are formed by a series of binomial factors in arithmetical progression, having any multiple of x for one part of each factor, and a constant number for the other part, [and] so that if the coefficient of x be added to any factor it gives the next greater factor, [and the values so formed] are called factorials, and the factors themselves are called succeeding values."

It is impossible that the author could have read over the preceding sentence before he sent it to the press. Indeed the latter as well as the first part of this book bears evident marks of great haste.

In a letter of mine in Number 127 of this Magazine, page 234, there is an oversight which I would request of your readers to correct. The last sentence should have been as follows :—

"I would likewise propose to any beginner, who studies neatness and elegance in his working, to solve the following question without multiplication :—Divide 44 into two such parts that the greater, increased by 5, may be to the less increased by 7, as 4 is to 3."

I remain, Sir,

Your most obedient servant,

Bija Gannita.

ELASTICITY OF AQUEOUS VAPOURS.

Sir,—I regret very much that a long absence from home has prevented my sending you the conclusion of the article, commenced in Number 123.

The column of mercury remaining at the height which corresponds to the degree of the temperature, experiments were made of lowering the

tube, by plunging its orifice to a greater depth in the subjacent vessel of mercury, and also of raising it; and it was found, in both cases, that the height of the column of mercury, above the level of that in the vessel, always remained the same. This is a plain proof that the elasticity of the vapour also remains the same, although the capacity of the space occupied by the vapour is diminished in the first case, and increased in the second; and this confirms the position, that at the same temperature the density of the vapour remains constant, as was said above.

The correspondence between the temperature of the vapour and its elastic force is as follows:—

Temperature.	Elasticity (in metres).
0°	0.005
10	0.009
20	0.017
30	0.031
40	0.053
50	0.088
60	0.145
70	0.238
80	0.352
90	0.525
100	0.760
110	1.069
120	1.462
130	1.941

It is to be remarked, that, with Dalton's apparatus, the temperature could not be carried higher than that of boiling water: hence the elasticities corresponding to temperatures greater than 100° (centigrade thermometer), were not found from observation, but from calculations made, upon the supposition that they go on according to the same law as that which they follow in lower temperatures, which law we shall proceed to investigate.

The temperature increasing in arithmetic progression, the elasticity increases nearly in geometric progression; and it will be found, in fact, that their logarithms increase with nearly equal differences.

But these differences of the logarithms, although they differ but little from each other, do not remain precisely equal, but go on slowly decreasing as the temperature is raised. Whence we may infer, that the elastic forces increase in a somewhat less proportion than that which is indicated by the geometric progression.

Laplace (Mec. Cel. tom. IV. p. 272) has given a formula, which represents with great exactness the results of the experiments of Dalton, and thus exhibits the true law of the increments of the elasticity of vapour. If p denote the elasticity corresponding to the temperature, t; then,

$$p = 0.76 \times 10^{\,\overline{10\,k\,(+-100) - m\,.\,(+-100)^2}}$$

where $k = 0.0154547$, and $m = 0.0000625826$.

With this formula, the elasticities belonging to each degree of temperature are readily computed; for it will be sufficient to add the number $k\,(+-100) - m.\,(+-100)^2$ to the logarith of 0.76, in order to obtain the logarithm of (p).

Bettancour has, by different experiments, established the same law.

We may hence easily see how surprisingly great the effects of aqueous vapours must be at very high temperatures.

I remain, Sir,

Yours respectfully,

F. O. M.

January 26th, 1826.

APPEAL IN BEHALF OF THE SPITALFIELDS WEAVERS.

[To the Editor of the Mechanics' Magazine.]

[We give, with much readiness, insertion to the following humane appeal to the numerous readers of the Mechanics' Magazine, in behalf of that most suffering class of mechanics—the Spitalfields Weavers, and earnestly hope that it will not be made in vain. The deepest misery has been brought upon them by causes wholly beyond their control; but, were the fact even otherwise, it is surely sufficient to know that many thousands of industrious men are absolutely perishing for want, to induce every brother mechanic, and every friend to mechanics, throughout the kingdom, to contribute his mite to their relief.—EDIT.]

At a time when one of the most honest and industrious of the labouring classes of this metropolis is suffering under the pressure of a calamity as dreadful in its effects as can well be imagined, it behoves every man who has it in his power to come forward and relieve them.

The rich man may give from his abundant stores, out of a feeling of humanity to his suffering fellow-creatures; the tradesman may give from his nearer connexion, and therefore better knowledge of a class to whom he is indebted partly for his own support, from humanity, and interest; the mechanic should, as far as lays in his power, give to relieve those with whom, in common, he shares alike in rank of life and a community of rights; and, as a subscription is now opened for the relief of the distressed Weavers of Spitalfields by the rich, I call upon the operative classes of the City of London to come forward and cast their mite into the treasury for the giving of bread to hundreds of those who are actually starving for *want of work!*

The distress at this time existing in Spitalfields is beyond calculation. None but those who have visited those abodes of want can form any idea of the fact. It is not in the power of description to paint the horrible distress these men are enduring—and enduring without an angry murmur, although driven to the appaling extremity of beholding their children perish with hunger, and feeling their own lives gradually wasting away under the same terrible calamity. In such a time of awful distress it would be inhuman to stop and inquire how it arose—whose fault it is. It is enough that those who are suffering brought not the disaster on themselves—they earnestly besought that the measure which has produeed such unexampled wretchedness should not have been carried;—in the name of humanity, then, relieve them!

It appears almost incredible that, in a city so wealthy, so abounding in every necessary of life, and so populous as London, that, for the last two months, 10,000 of its inhabitants should be dying for lack of food!—yet such is the heart-rending fact. I feel confident that, on the slightest hint being given to the operatives of London of this state of a large portion of their fellow men, that they will unhesitatingly come forward, and as liberally as they feel it to be just, give a helping hand to feed them and their families with bread. Their generous hearts want no other stimulus than that of misery to excite them to the feelings of compassion! Let them then show by their actions that they, as well as the more polite and refined, can feel in an equal degree for another's woe, and act up to the golden rule of "doing unto others as they would others should do unto them."

I hope these few hints, weak in comparison to the fact they are intended to represent, will have the effect of rousing those to whom I write to the exertion of benevolence; and I propose that the Editor of the Mechanics' Magazine will be so good as to open his pages for the reception of subscriptions to the fund raising for the relief of the Spitalfields Weavers, to be by him forwarded to the General Committee.

It would not, perhaps, be amiss to publish a few particulars. The Workhouse, built to contain 400, has in it 800; and the inmates are obliged, for want of room, to stand all day and night and sleep by turns. A fever, occasioned by want of air, rages in the place among the children, of whom eight on an average die daily, and it is feared the disease will spread to the older inhabitants. Twelve hundred families receive weekly relief! The statement speaks for itself.

A Friend to the Poor Weavers.

WIND-LATHE.

Sir,—In Number 113 of your valuable Publication, there is a description given of a Wind-Lathe, or what I should rather call a Horizontal Windmill, by a person signing himself "R. H." Conceiving that such a power might with advantage be applied to actuate a two-horse threshing machine, I constructed a model on R. H.'s principle, and, as far as *that* goes, find it answer my fullest expectations; but knowing how defective these are in general, when compared with the actual engine, and that many have been led into serious losses by supposing that the machine, in its full size, will work equal to the model, I have deferred any farther proceedings until some more particular description shall be afforded by R. H., which in the article he has promised to do. R. H. will confer a favour, if he will give a more accurate description of the several parts of the machine; viz. what should be the length and depth of the arms or wings; the breadth of the narrow slips of board to act in the manner of a Venetian blind; the height the arms or wings should be elevated above the ground, so as to obtain a sufficient power from the wind; the whole calculated to work a threshing-machine of three or four horse power, with fanners, &c. attached to it, for cleaning the corn.

The above being inserted in your next publication, will oblige a constant subscriber,

N. W. G.

IMPERISHABLE CABLES.

Sir,—Perhaps the following account of the method used in India for preserving cables, &c. may not be wholly unacceptable to some of your readers. It was communicated to me by a friend who has resided in that part of the world for several years.

Throughout Bengal, and in other parts of India, is a common tree called Chotha Ghaub; in appearance it is similar to the Portugal laurel; it bears a small fruit of the size of the English damson, of a green colour, containing one or two brown seeds. In its ripe state it is made use of by the natives for colouring their ropes and nets; on which it has this effect, that if the process be renewed two or three times a-year, they become imperishable in water. The natives also colour the wood of their boats with the same material, to keep off insects; and the only process the fruit undergoes previous to its being rubbed on the material to be coloured, is that of being pounded in a mortar, or rubbed to pieces with the fingers.

Not being acquainted with botany I cannot inform your readers as to the name assigned by Linnæus to this plant, but the foregoing description may perhaps suffice.

With my best wishes for the success of your valuable Magazine, from which I have received much information,

I am, Sir, yours, &c.

H. C—ll.

Chigwell.

MACHINE FOR PRESSING STRAW BONNETS.

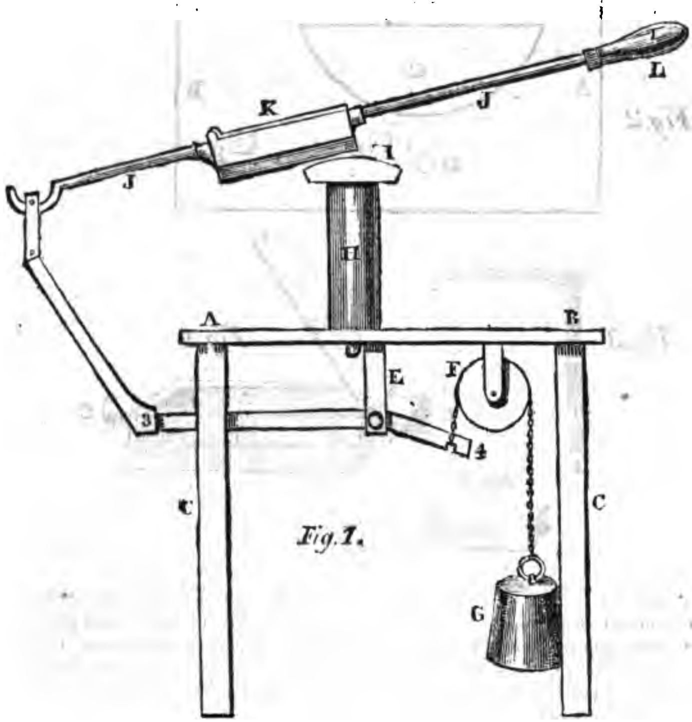


Fig. 1.

Sir,—Observing in the Mechanics' Magazine for October, an inquiry relative to a method of Pressing Straw Bonnets, I take the liberty of submitting to you a sketch and description of a machine for this purpose, of which there are many in use in my neighbourhood, and which are found to answer extremely well.

I am, Sir, yours, &c.

T. N.

Description.

Fig. 1. AB, the edge of the table or bench.

CC, two of the four legs, which support the table, morticed into the four corners of it.

3, 4, A cast-iron lever, whose fulcrum is a bolt, passing through it and the crutched iron, E.

E, the crutched iron, with two straps to embrace the lever screwed into a nut, which is let into the top of the table, as seen at C, fig. 2.

F, a cast-iron pulley, working in another crutched iron, and screwed into a nut, as seen at F, fig. 2.

G, a weight suspended by a strong cord, passing over the pulley F, the other end of the cord being fastened to the lever at 4.

H, a piece of wood turned cylindrically, about 3 inches in diameter and 9 inches high, at each end of which is a cylindrical pin, the lower one entering the table at H, fig. 2.

I, a hat-crown block, fitting the upper pin of the cylinder, H. Of these blocks as many may be used as shall be found requisite.

JJ, two pieces of wrought-iron

Fig.2

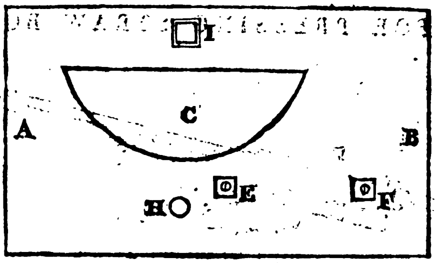
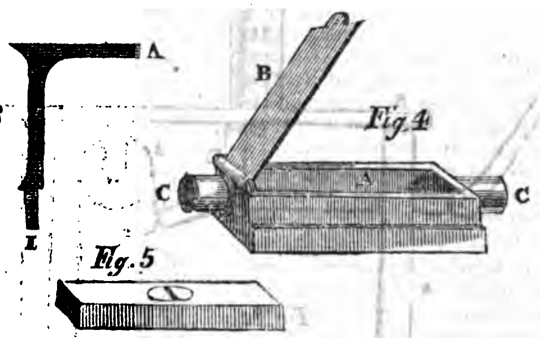


Fig.3

Fig.4

Fig. 5



screwed into the ends of the cast-iron box, K; one of these pieces having a hook, to work into the hole of the lever, 3, 4, which becomes the fulcrum of this second lever. Upon the extreme end of the other piece, a wooden handle is put.

Fig. 2. AB represents the top of the table or bench, made of 1½ inch beech plank, 2 feet 3 inches long, and 1 foot 4 inches wide.

C, a hole cut in the table for the peaks of bonnets to be put through, while the sides are pressed. This hole is the segment of a circle, whose centre is in a line drawn perpendicular to the edge of the table, and through the centre of the block-hole, H; it is 1 foot 3½ inches long, and 6½ inches wide in the centre.

Fig. 3, A cast-iron mandril, whose lower end, I, fits a square cast-iron socket, I, fig. 2, which socket is firmly fastened in the table. This mandril stands about 9½ inches high; the top, A, is about 7 inches long; the upper side is made broader than the lower side, thus forming a dovetail, which slides into a dovetailed groove made in the peak-block. This iron is about 1¼ inch square. The use of it is to support the peak-block during the operation of pressing bonnet-peaks, at which time it is necessary to remove the crown-block, with the cylinder which supports it.

Fig. 4, A cast-iron pressing-box, whose face is polished, as are also the edges, about one inch up; the face is 3¼ inches wide, and 8½ inches long; its exterior depth is 2¾ inches.

A is a cavity, into which two heaters, fig. 5, are put successively while hot; this cavity is 7½ inches long, 2 inches wide, and 1½ inch deep.

B, a cover, made of stout plate-iron, working upon a pin at one end.

CC, two circular projections, each of which are drilled, and screwed to receive the ends of the pieces, H, fig. 2.

Fig. 1 is enclosed with half-inch boards nailed to the outsides of the four feet, except at the back of the weight, at which a small door will be found convenient for the purpose of increasing or diminishing the weight when found necessary.

DRAINING LAND.

[*To the Editor of the Mechanics' Magazine.*]

Sir,—As an old subscriber to your valuable work, I solicit the privilege of introducing to its pages a subject that, in point of utility, is scarcely inferior to any with which it has favoured the public, and which, to the agricultural interests of the kingdom, is of the first importance—I allude to the art, if it may be so called, of Draining Land. It is not with a hope of throwing any light on the subject by any knowledge or ingenuity of my own that I request the attention of your readers, but I certainly do entertain a hope to excite the ingenuity of others to effect an object of national and paramount consequence.

I have been led to these reflections by an undertaking to which a long absence from the kingdom had rendered me a perfect stranger, but in which I have now been engaged, with short intermissions, for a period of six years. The extent of my operations has been limited to about three hundred acres of land, naturally fertile and divided into closes of, on the average, five acres; but, from the commencement to the conclusion of my labours, I have been impressed with a conviction that a much less laborious and expensive mode of attaining the same end might be devised, if the subject were once to obtain due consideration from acute and ingenious mechanics.

The general, and, indeed, the almost only known method of draining in this part of the country is to dig a gutter to the necessary depth, and of a sufficient width to admit a man to work with a hoe and shovel, somewhat about twenty inches. The depth is of course uncertain; few of mine are less than six feet, and some are thirteen, at which additional width is requisite to allow sway for the shovel in order to throw the under earth, or *deads*, as it is here called, to the surface. When the gutter is made to its proper depth, the business of *walling* begins, by raising a narrow ridge of stones a foot high on each side of the drain, leaving a gutter between them of about a foot wide, and covering it with large flat stones. It is then *filled in*, by which is meant, that a number of rough stones, that admit of ample interstices, are thrown on the covers till they reach within a short distance of the surface. The drain is then covered over with the soil, and completed.

The great expense and labour of the process proceed from the great, and for the mere purpose of carrying the water, the unnecessary width of the gutter, which produces the following effects:—

1st. The expense and labour requisite to dig and throw up the under earth or deads.

2nd. The immense quantity of deads to be removed, sometimes to a considerable distance.

3rd. The quantity of stones to be procured and carried for the walling and filling.

4th. The unproductiveness of the ground over the gutters, which, during the summer, is quite parched, when the adjoining ground is moist and verdant.

5th. Its great liability to be injured by moles and water-rats.

These remarks must already have suggested to your readers that it appears to me practicable, though I leave it to others to discover the means, to make a gutter or drain of a breadth no greater than is actually necessary to carry the water; for which purpose six or eight inches is quite sufficient for any of the springs that occasion swamps in this neighbourhood, and *filled* nearly to the surface, would carry an immense stream of water.

Difficulties must of course present themselves to any that turn their attention to the subject, but still the infinite importance of a discovery that thousands will immediately avail themselves of, will, I trust, be a sti-

mulus to the exertion of your scientific readers, and exonerate me from wantonly proposing to them an impracticable or chimerical task.

C——.

South Hams, Devon.

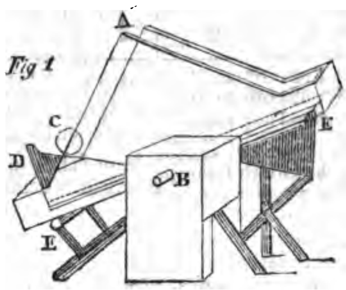
SHUTTLEWORTH'S HAND-SAW MILLS.

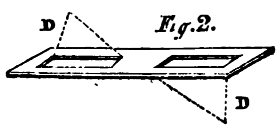
Sir,—In your last publication, No. 128, page 248, there is a description of a Hand-Saw Mill, by Mr. Shuttleworth. I wish to ask him what power or speed he gains by his three-toothed wheels, as the two small ones appear of the same size, and of course the same number of teeth? My opinion is, that his only *gain* is a *loss*, and that a considerable one, both in power and speed, by the great friction occasioned by the working of the wheels under such disadvantages.

A Mechanic.

February 6th, 1826.

PERPETUAL PUMPS.





Sir,—The description of "Viator's Perpetual Pump," in your 100th Number, has suggested to me, whether the long-sought "Perpetual Motion" may not be found by a simple mechanical alteration of that machine, and substituting a cannon-ball as a *primum mobile*, in lieu of the water, *not always obtainable*. I would recommend, that in the bottom of the trough be inserted, at each end, two dropping-boards, of a triangular form, moving on an axis at one corner, one of which falling below the level of the trough at the elevated end, the other shall be raised by the stop affixed to the standard post, which, throwing the ball again back to the former end, shall depress that, until the same process is repeated in perpetual activity.

Description.

Fig. 1. A, the trough, swinging on an axis at B.

C, the cannon-ball, raised by one of the dropping-boards, D, whilst the other falls through the opening at E, into the trough.

F, the support, or stop, raising the dropping-board, D.

The centre of the trough ought to be pierced, leaving the sides as a support to the ball, which ought not to be wider than that the ball may travel freely through.

Fig. 2. DD, the dropping-boards, which pass through the centre, so as to leave a sufficiency of the trough as a resting-ing-place for the ball to give a momentum, and depress the trough, previously to its being again raised by the dropping-board.

I am, Sir, yours, &c.

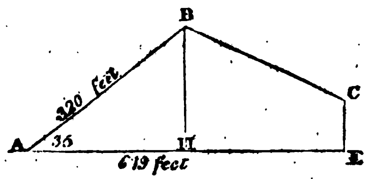
M. G. R.

TABLE OF FACTORS FOR MINING PURPOSES.

[To the Editor of the Mechanics' Magazine.]

SIR,—I take the opportunity to submit to your inspection a Table of Factors of Forty-five Degrees, which I have adopted for mining purposes. It may be acceptable to some of your Correspondents, particularly those engaged in the mining sphere.

Degrees.	Factors.	Degrees.	Factors.	Degrees.	Factors.	Degrees.	Factors.	Degrees.	Factors.	Degrees.	Factors.		Factors.	Degrees.	Factors.
1	1.000	7	1.007	13	1.026	19	1.057	25	1.103	31	1.166		1.152	43	1.366
2	1.000	8	1.009	14	1.030	20	1.065	26	1.112	32	1.178		1.269	44	1.390
3	1.001	9	1.012	15	1.035	21	1.071	27	1.122	33	1.192		1.286	45	1.414
4	1.002	10	1.015	16	1.040	22	1.078	28	1.132	34	1.206		1.305		
5	1.003	11	1.018	17	1.045	23	1.086	29	1.143	35	1.220	41	1.325		
6	1.005	12	1.022	18	1.051	24	1.094	30	1.157	36	1.236	42	1.346		



Admit AE to be an adit of 619 feet, and the surface AB making an angle of 35 degrees with the horizon, the distance AB equal to 320 feet, and the angle of depression from B to C 12 degrees. Ascertain the point, C, in order to sink a shaft perpendicular over the point E. Divide AB (with three cyphers to the right) by the factor of the angle A, 320.000 ÷ by 1.220 = 262 feet 4 inches, the base, AH. AE — AH = HE = 356 feet 8 inches; 356.7 × 1.022 the factor of the angle B = 364.5474 = 364 feet 6 inches, the distance from B to C. If the angle exceed 45 degrees, or the perpendicular be required, invert the triangle and let the base be the perpendicular. The factors may be extended to a greater number of decimals, but it is sufficient for mining purposes. I have made numerous experiments with them, and never failed to hit the mark intended.

I remain, Sir,

Your obedient servant,

WILLIAM TONKIN,

Mine Agent, near Fowey, Cornwall.

CALCULATION OF ECLIPSES.

SIR,—In Number 125 of your very instructive miscellany, the Mechanics' Magazine, is a reply, by Eclipticus, to a question on Eclipses in a preceding Number, pointing out when the first total and annular eclipses may be seen in England; and stating that his computations are made from the tables published in Vince's Astronomy. I have in my possession Vince's Astronomy, and have frequently attempted to compute an eclipse from the tables contained in that work, but my attempt has always failed at the beginning.

Mr. Vince says, vol. I., art. 544, "the first thing to be done is to find the time of the *mean* opposition; to get which, from the tables of epacts, amongst the tables of the moon's motion, take out the epact for the year and month," &c. Now I do not perceive that there are any such "tables of epacts" amongst the "tables of the moon," in the third volume, or in any part of the work. But, perhaps, I do not understand truly the nature of the tables; and if Eclipticus, or any other of your Correspondents, will have the goodness to point out to me my deficiency in understanding the tables, and show (by an example) how the time of the mean opposition is found, he will confer a very great favour.

Mr. Editor, your insertion of these few lines as early as convenient, will much oblige your constant subscriber and very humble servant,

AMATOR ASTROLOGIÆ.

Liverpool, Jan. 31, 1826.

SAFETY-GIGS.

SIR,—As the article in your 124th Number, on Mathews' Safety-Gig, is undoubtedly written by some interested person, who is evidently a puffer without pretensions, and as his assertions respecting chaises in general use are not, in my opinion, founded on truth, I am desirous of endeavouring to correct the misstatements there inserted; also to offer some observations on the safety-gig, that your readers may be able better to judge of the merits or demerits of the invention.

Your Correspondent sets out with remarking, that there is a force acting on a horse to throw him down, when he trips, nearly equal to two tons. Two tons! mark that, Mr. Editor. Now, I confess, I am at a loss to understand upon what principle he has made this calculation. The resistance which I conceive there is to a horse recovering, is in proportion to the weight pressing on his back; for a well-constructed gig seldom bears more than 30lbs. on the backborn, consequently there should not be more than that force acting on him at the time of tripping, unless we are to take into the account the velocity the chaise is moving at; if so, the force is in proportion to the weight and velocity jointly. The motion given to a chaise is as the space passed through in a given time by the horse, without any distinction as to the kind of gig; therefore the force occasioned by the velocity must be the same in Mr. Mathews' safety-gig as in all others.

I have driven a variety of horses, and never found, when they tripped, any considerable difference in the lowering of the shafts of the chaise, until they were beyond the power of recovering their feet. If I may be allowed to diverge a little, I will submit an observation which may be found partially useful to many horses in their tripping; this can be done by attending to the bearing rein. Generally, when the harness is put on, the horse's head is borne up to the saddle as tight as may seem necessary at the time he is standing, but the instant he moves at a quick pace, he carries his head much higher, and the rein becomes quite loose and useless. Every person that is accustomed to riding or driving must know how much a horse is held up by keeping the reins tight in hand. There is a custom with our town carmen, which, I think, is worthy of remark. When they drive down a sharp hill, they invariably hold the whip before the eyes of the

shaft-horse, for the purpose of keeping his head up; while they can do that, there is little fear of a horse losing his feet.

But to return to the safety-gig. Your Correspondent makes his calculations upon a horse that travels at the rate of ten miles an hour, which rate is for him unfortunately selected; for it is an admitted fact, that a horse that moves at that pace is the least likely to trip, as he is full of spirit, lifting his legs well up to get over the ground, and should he by chance make a stumble, he has more vigour to recover himself; but when a horse is moving at the rate of five or six miles per hour, sluggish and tired, then it is that he is more likely to trip and go down, and the danger occurs. When a horse falls, he generally drops on the shafts, which, if they are made of lancewood, frequently get broken.

He also says, that "no *conceivable strength* or weight of iron, or timber, if attached to the shafts, can be sufficient to sustain the weight of a horse moving at a great rate" (falling on them, I suppose, he intends to say). To this, I shall only refer him to the Stanhopes now in use in all parts of London, which I have no recollection of having seen or heard of the shafts being broke by the horse falling on them. I might almost venture to say it is impossible—I am sure it is improbable it could occur, if the Stanhope is properly built. It may be here necessary to explain, that the shafts are made of ash, about 1¼ inch deep, and lined on the under part with an iron plate *half an inch* thick in the middle (this is a very *conceivable strength*), and rounded off at the edge, which being annealed, would bend to the ground before it would break: it is to chaises with shafts made of lancewood that the invention is more applicable, for they will not admit of any plating in consequence of their elasticity.

So much for the preference the safety-gig deserves for its protection to shafts. Now, for the beauty of this *addition*, we cannot call it an *improvement*; it is not unlike the man's horse when he cut his tail off: he observed to a bystander that "it was an *addition*." "I can't see that," replied the other; "it may be an *improvement on the whole*." Your Correspondent says there is nothing inelegant in it; I do not know what his ideas of elegance may be, but I think it would have been as well if he had omitted that, unless he considers *large* scroll-irons (they are not small, as he says), reaching within a few inches of the ground, and projecting above two feet from the front of the wheel, are to be looked at as a beautiful appendage; if so, I think it will be necessary for him to accommodate the public with his spectacles to see through.

Now for the practicability of this surprising invention. In the chaise shown at Mr. Lambert's, the scroll-irons come within six inches of the ground, without its load of two persons in it, which would bring it down at least four inches, consequently the scrolls will be within two inches of the ground. (I have a chaise in constant use, which, when it has two persons riding in it, the springs go down *seven inches* on a rough road.) If the safety-gig should have to run over ruts, and occasion the springs to vibrate, then the irons must be continually striking against the ground, which being attached to the body, must give it a motion something worse than a costermonger's cart without springs; also, if it should be required to take a third person for a short distance, or any luggage, the irons will drag on the ground; if there is any elasticity in the springs, or if one wheel should be in a rut, then it must also drag on the ~~ground, when it has~~ only its intended weight in it. Perhaps it will be said that these objections can be remedied by shortening the scroll-irons; if so, should a person of nine stone be riding alone in a chaise, the irons will be so far from the ground as to make them quite useless.

In truth, the difficulties preponderate so much in Mathews' improvement, that, to use the old expression, the remedy is worse than the disease. It is the opinion of me-

chanics generally, which I state on good authority, that it is no invention at all, but an idea that has been thought of by almost every man in the coach business, but was not of sufficient use, with all its objections, to be worth putting into practice.

I am, Sir,

Your obedient servant,

T. A.

Newington Road.

PRIZE CHRONOMETERS.

The following is the Official Report for December last :—

	No.	"
French	89/3512	2,56
French	975	3,56
Harris	678	4,09
Molyneux	862	4,81
Desgranges	35	5,64
Tayler	602	6,55
Cathro	1703	6,56
Webster	638	7,17
Cotterell	637	7,33
Jackson	512	7,65
Cotterell	647	7,65
Cathro	1685	7,77
M'Cabe	167	7,81
Porthouse	6281	8,81
Desgranges	20	8,90
M'Cabe	168	9,09
Jackson	675	9,09
Ellicott	947	9,65
Finer & Nowland	304	10,41
Lowden	2	10,56

NEW PATENTS.

Augustus Count de la Garde, of Saint James's-square, Middlesex; for improved machinery for breaking or preparing hemp, flax, and other fibrous materials: communicated to him by a foreigner. Dated Nov. 24, 1825.—Six months to enrol specification.

Joseph Eve, of Augusta Georgia, America, now residing at Liverpool, engineer; for an improved steam-engine. Dated Nov. 24, 1825.—Six months to enrol specification.

Henry King, of Norfolk-street, Commercial-road, Middlesex, master-mariner, and William Kingston, of the Dock-yard, Portsmouth, master-millwright; for improved fids for top-masts, gallant-masts, bowsprits, and all other masts and spars to which the use of the fid is applied. Dated Nov. 26, 1825.—Six months to enrol specification.

Richard Jones Tomlinson, of Bristol, gentleman; for frame-work for bedsteads, and other purposes. Dated Nov. 26, 1825.—Six months to enrol specification.

Marc Lariviere, of Princes's-square, Kennington, Surrey, mechanist; for certain apparatus or machinery to be applied to the well-known Stamp's fly presses, or other presses, for the purpose of perforating metal plates, and for the application of such perforated metal plates to various useful purposes. Dated Nov. 28, 1825.—Six months to enrol specification.

William Pope, of Ball-alley, Lombard-street, London, mathematician; for improvements on wheeled carriages. Dated Dec. 3, 1825.—Six months to enrol specification.

The Same, for improvements in making, mixing, compounding, improving, or altering the article of soap. Dated Dec. 3, 1825.—Six months to enrol specification.

Henry Berry, of Abchurch-lane, London, merchant; for an improved method, in different shapes or forms, of securing volatile or other fluids, and concrete or other substances, in various descriptions of bottles and vessels. Dated Dec. 3, 1825.—Six months to enrol specification.

Ezekiel Edmonds, of Bradford, Wilts, clothier; for improvements on machines for scribbling and carding sheeps' wool, cotton, or any fibrous articles requiring such process. Dated Dec. 3, 1825.—Six months to enrol specification.

John Beever, of Manchester, gentleman; for an improved gun-barrel. Dated Dec. 3, 1825.—Six months to enrol specification.

Edmund Luscombe, of East Stonehouse, Devon, merchant; for a method of manufacturing or preparing an oil or oils extracted from certain vegetable substances, and the application thereof to gas-light and other purposes: partly communicated to him by a foreigner residing abroad. Dated Dec. 6, 1825.—Six months to enrol specification.

John Phillips Beavan, of Clifford-street, Middlesex, gentleman; for a cement for building and other purposes;

communicated to him by a foreigner. Dated Dec. 7, 1825.—Six months to enrol specification.

Francis Halliday, of Ham, Surrey, Esq.; for improvements in machinery to be operated upon by steam. Dated Dec. 9, 1825.—Six months to enrol specification.

Joseph Chesseborough Dyer, of Manchester, patent card-manufacturer; for improvements in machinery for making wire cards for carding wool, cotton, tow, and other fibrous substances of the like nature; and also certain improvements on a machine for shaving and preparing leather used in making such cards. Dated Dec. 9, 1825.—Six months to enrol specification.

Robert Addams, of Theresa-terrace, Hammersmith, Middlesex, gentleman; for a method of propelling or moving carriages of various descriptions on turnpike, rail, or other roads. Dated Dec. 14, 1825.—Six months to enrol specification.

Matthew Ferris, of Longford, Middlesex, calico-printer; for improvements on presses or machinery for printing cotton and other fabrics. Dated Dec. 14, 1825.—Six months to enrol specification.

James Ashwell Tabor, of Jewin-street, Cripplegate, London, gentleman; for means for indicating the depth of water in ships and vessels. Dated Dec. 14, 1825.—Two months to enrol specification.

John M'Curdy, of Cecil-street, Strand, London, Esq.; for improvements in generating steam. Dated Dec. 27, 1825.—Six months to enrol specification.

James Ogston and James Thomas Bell, of Davies-street, Berkeley-square, London, watchmakers; for improvements in the construction or manufacture of watches of different descriptions: communicated by a foreigner. Dated Jan. 6, 1826. Two months to enrol specification.

Richard Evans, of Bread-street and Queen-street, Cheapside, coffee-merchant; for improvements in the apparatus for and process of distillation. Dated Jan. 7, 1826.—Six months to enrol specification.

Henry Houldsworth, the younger, of Manchester, cotton-spinner; for improvements in machinery for giving the taking-up or winding-on motion to spools or bobbins and tubes, or other instruments, on which the roving or thread is roving, spinning and twisting machines. Dated Jan. 16, 1826.—Six months to enrol specification.

Benjamin Newmarch, of Cheltenham, Esq.; for an improved method of exploding fire-arms. Dated Jan. 16, 1826. Six months to enrol specification.

John Rothwell, of Manchester, tape-manufacturer; for improved heald or harness for weaving purposes. Dated Jan. 16, 1826.—Two months to enrol specification.

Henry Anthony Koymans, of Warnford-court, Throgmorton-street, London, merchant; for improvements in the construction and use of apparatus and works for inland navigation: communicated by a foreigner. Dated Jan. 16, 1826.—Six months to enrol specification.

(The remainder in our next.)

NOTICES TO CORRESPONDENTS.

"Verax" does us great injustice in ascribing our Prize Chronometer Reports to "subservient and sinister motives." We have no object whatever to serve by them beyond those of gratifying scientific curiosity, and doing justice to meritorious ingenuity.

Mr. Smith's communication came too late for insertion this week.

Communications have been received from S. F. J. A.—Nota—Dyer—J. Ham—Dr. Burney—A Lincolnshire Fenman—Mr. Shuttleworth—J. O.—H. G.—M. F.—Mr. Jones—Fermor—Agrotus—Axis—P. P.—Oculus—N. A.

*** *Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

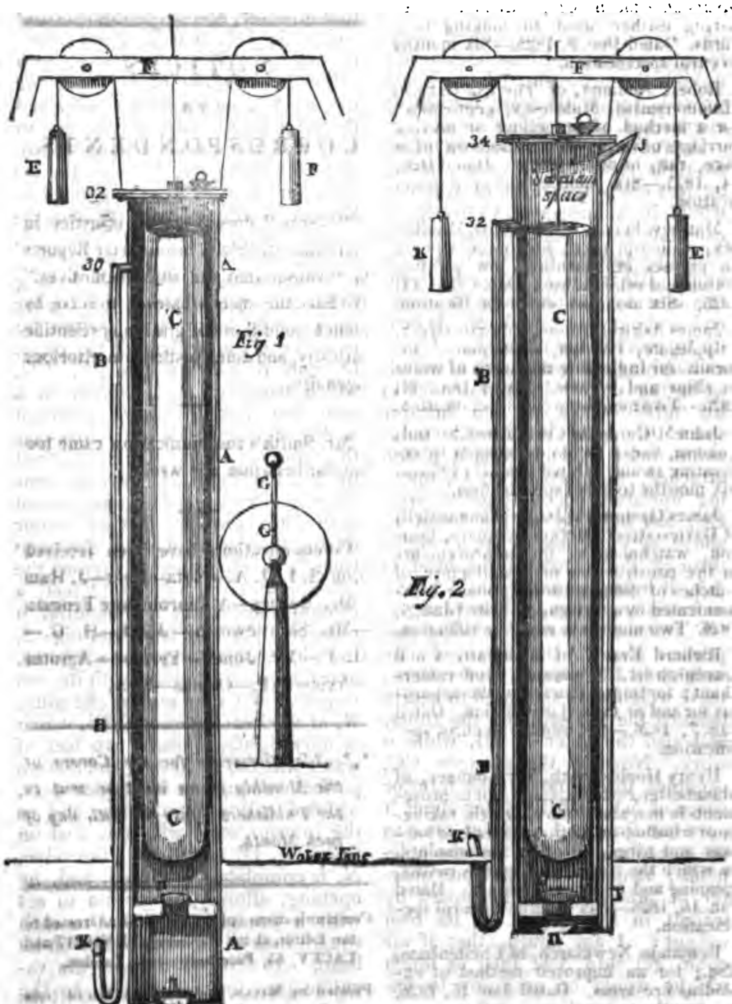
Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by Mills, Jowett, and Mills (late Bensley,) Bolt-court, Fleet-street.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 130.] SATURDAY, FEBRUARY 18, 1826. [Price 3d.

VACUUM WORKING POWER.



VOL. V.

VACUUM WORKING POWER.

SIR,—The candid manner in which communications are discussed in your valuable Magazine, encourages me to submit the following attempt to prove, that a Vacuum may be produced as a Working Power, without steam or gas, to the investigation of your experienced Correspondents. I sent an engraving of the proposed mode to a few scientific men, about three years ago; probably I aimed at too much, in supposing it capable of giving continued motion; I therefore, in the prefixed drawings, merely exhibit the principle, which, if approved, I can illustrate farther by engravings, at any future time.

AAA represent the section of an air-tight tube full of water, rising 32 feet above the level of water in which it is supposed to work. I calculate here, that the atmosphere will lift water 32 feet high in a vacuum. BB is a small side-tube opening into AA, at 30 feet; its lowest end is about that of AA, and is bent up to receive the plug, K. CC, I call a plunger at rest, made of metal, as having no air in it, intended to fill three-fourths of the interior space of AA; its lowest point about water level: here is a piston attached, with the valve, D, opening upwards, which, together with CC, are held up to the beam F, above, by a rod passing up, air-tight, through the centre of the head of AA, it being intended that AA shall move up and down, and the plunger, CC, remain at rest; AA being suspended also to the beam, F, by weights in EE, passed over rollers: these weights are supposed to nearly balance the material of the tubes, and also the water in BB, while at work. Now, as the plunger, CC, occupies three-fourths the interior space of AA, and the water about it only one-fourth, I come at once to the question on which the whole depends, namely—Will this one quarter of water be counterpoised by weight in EE, equal to its own weight? I am aware, that if air could get into AA, then as much weight would be necessary to balance this one quarter of water, as if AA were full without the plunger; but as AA is air-tight, I am of opinion, that the atmosphere pressing on the valve, N, at the bottom of AA, and equal to 32 feet in height, will support the column of water, and thereby allow the weight in EE to be only equal to the specific gravity of the said one quarter of water round the plunger, CC, in order to keep the whole in a balanced state when at rest. It is from this reduction of water, and its counterpoising weight in EE, that I expect to derive power. The tubes having been filled through the funnel upon the top of AA, and well plugged, and the plug K, at the bent up end of BB, weighted so as to support two feet of water only, because the atmosphere presses here also equal to 32 feet (I adopt in the present instance the graduated weight, GG, which, proceeding from nothing, descends about 90 degrees), having lifted the tubes two feet higher from water level, and carried up two feet of water through the valve, D, and round the plunger, CC, which being at rest, is now in a two feet lower relative situation in AA, fig. 2; it will be found that this tube is still full of water, forced up by the valve N having kept close in consequence of being loaded with more than 32 feet of water during the rise of AA; at the same time, it has continued to support the interior water as high as 32 feet, a circumstance which it is material to observe. At two feet rise, fig. 2, the whole appears again at a balance, and the valve, D, closes with its own weight. If I now remove the plug, K, at the bent up end of BB, which is only lightly closed, two feet of water will fall from AA, and leave a perfect vacuum in its upper part, which I call vacuum space; and as the interior water will now rest on the valve, D, and piston, the valve, N, is completely unloaded, and, by opening, allows the vacuum to act with a pressure of 15lb. to each square inch of the area of AA on its head. At two feet descent the vacuum space has come down to the

water held up by D, and again filled itself, and the whole is again in equilibrio, as in fig. 1. I must deduct from this vacuum pressure the opposing weight in EE, which weighs the one quarter water, and that in the lever, GG; and this latter, not having the assistance of the atmosphere, must be calculated to lift two feet of the whole interior area of AA, without the plunger. I think the piston need not be completely water-tight, though nearly so. Some water must pass out of AA whilst it is rising, because the rod is entering into it; this may be done by a small pipe proceeding from the top of AA, to below water level. See II, fig. 2. I consider the water as only a sort of packing to produce, and then preserve, the vacuum.

	lbs.
Suppose the tube AA two feet bore = 452 square inches × 15lb. =	6780
Deduct the weight in EE, that balance the quarter water	1695
	5085
Deduct the graduated weight in GG, which lifts two feet of water the whole area of 452 inches, the average of its weight must be 1-32d of vacuum pressure, about 212lb.	212
	4873

Leaving a surplus power of 4873lb. in whole numbers.

N.B. One half of this surplus power may be thrown into the weight, EE; there would then be 2436,5lb. to work the up stroke, and 4873lb., minus this 2436,5lb., working the down stroke. Would not a fly-wheel produce the changes from up to down in such a balanced machine, with moving machinery suited to its power?

I remain, Sir,

Your obliged servant,

Z——.

WYNN'S IMPROVEMENTS IN CHURCH AND TURRET CLOCKS.

Sir,—The public is greatly indebted to you for your valuable Miscellany, as a vehicle for communicating an infinite deal of useful information; and in no respect do you render it more useful than by your ready insertion of letters, which appear to be continually flowing in upon you.

The "Hint of a Traveller," in Number 127, is one which deserves the attention of your readers; but his suggestions to remedy the defect of the want of ascertaining the hour by the striking of Church and Turret Clocks, from his want of practical knowledge on the subject, are not judicious. The striking part of a large clock has already too much mechanical resistance to encounter, in having to raise a hammer sufficiently powerful to bring out a full tone from a large bell so many times at one winding up of the weight; and it would much lessen the means of producing the necessary power, to burden the machinery with lifting two hammers instead of one, besides adding a great deal of complexity to the machine. The great defect the "Traveller" complains of, is owing to the bad construction of the hammers of all public clocks, which are too feeble to put the bells in vibration; and the sounds produced by them are not sufficiently intense to awaken the attention of the auricular organs, till they have been repeated perhaps several times, and thus the first sounds are lost, and the hearer is deceived in the hour which he supposes the clock to have struck. The fault might be remedied by the application of my improved hammer, a description of which you had the kindness to in-

sert in your 45th Number, which could be applied to any clock at a very moderate expense, and which would bring out such a full tone from the bell, as to make it be heard distinctly all round its neighbourhood. It is only necessary for me to request any persons to compare the sounds produced by the striking of a clock with those produced by ringing the same bell, to prove the truth of what I have advanced. In almost all instances, it will be found that the former are much less intense than those of the latter. In fact, I was in a cathedral churchyard, a few miles westward of London, the other day, when the clock struck the hour; the same bell was immediately after rung, and the sound produced by the clock was so much inferior to that of the mere tolling of the bell, that one would have thought it was struck with a muffled hammer. This is by no means a solitary instance; on the contrary, it will be found to be a general defect, and is occasioned by the very bad construction of the hammer-work of all public clocks, and which renders the mechanical power of the machinery to be exerted in vain.

With respect to the "Traveller's" suggestion of a warning blow, at a short period previous to the striking of the clock, he will find that very usefully given in clocks which strike the quarters.

There is as great defect in the rate of going of public clocks, as there is a want of sound produced by the bells, owing to their great exposure to the wind, the force of which acting on the hands, is continually accelerating or retarding the motion, and producing a variation, which, in the country, where good instruments are not to be obtained, renders it difficult to keep them at any thing like true time. I was passing the evening at a commercial inn, a short time since, where I was joined by a brother traveller of your Correspondent, who began remarking (without knowing I was a clock manufacturer), that he had found a variation of a quarter of an hour in the public clocks in the different towns he had passed through. It is needless for me to point out the inconvenience attending such a variation as this, in machines which are or ought to be the correctors of the time to the inhabitants of their respective neighbourhoods. It is a subject which I have long been acquainted with, and I have at length found the means of remedying this defect, as I can prevent the force of the wind from having the least influence whatever on the clock, and can consequently construct a clock with any number of dials, of any diameter that may be required, that would keep time like a time-keeper. This improvement, as well as that of my hammer, can easily be applied to any clock already made.

I am now constructing a clock for one of the finest churches in the kingdom, with the improvement described in your 45th Number, and with several others, for which I have had the honour to receive two rewards of twenty guineas, and one gold medal from the Society of Arts, Manufactures, and Commerce. I feel no hesitation in putting this in competition with any clock that has yet been made, both for consistency of design, and accuracy of workmanship. In fact, I can take upon myself to say, there are many parts about it which have not been equalled by any clock-maker; and I should feel much pleasure in showing it to any gentleman having a taste for mechanical pursuits, who would favour me with a call; and should the "Traveller," for whose remarks the public is indebted, be coming to London, I should feel much pleasure in showing it to him.

I am, Sir,
Your most obedient servant,
WM. WYNN.

Dean-street, Soho-square.

LARCH BARK.

SIR,—Having been a subscriber to your valuable Publication from its commencement, perhaps I may be allowed to intrude on its pages

for a purpose that is perfectly compatible with its object, and to request the favour of being informed by some of your intelligent Correspondents, on the subject of Larch Bark, as constituting a substitute for the bark of oak, in the preparation of leather.

I recollect to have seen in a very excellent work on Agriculture, that during the late war, the bark of the larch had been successfully applied to this purpose in the northern counties, and on that authority I have endeavoured to prevail on the tanners of this neighbourhood to give it a trial; but prejudice, the bane of science, or at least of its application to purposes of utility, has prevailed over my arguments, and on every occasion I have been obliged to succumb.

If the bark of larch contain but in a limited degree the property of tanning, a very desirable end may be partially obtained, namely, the prevention of our finest oak timber being felled at a season when its pores are open, and it is particularly subject to decay. The larch plantations of this kingdom are now numerous and extensive; its timber is excellent for building; the trees in most of them approach maturity, and if possessing the quality adverted to, will not only prevent the untimely demolition of our forests, but will afford to the planter an additional stimulus to their cultivation. With this view, I will submit to your Correspondents the following inquiries:—

1. Whether the larch bark be now used as a substitute for the bark of oak, and in what part of the kingdom?

2. What quantity of the tanning property, compared with oak, is it found to possess?

3. What season is most favourable for rinding, to preserve that property?

4. What price does it generally bear with relation to oak bark?

I remain, Sir,

Your most obedient servant,

C——.

South Hams, Devon.

SHIP-BUILDING.

Sir,—I am induced by the encouragement your numerous Correspondents have met with, to solicit your permission to occupy a small space in your valuable pages.

On perusing Number 124, Jan. 7, I find some strange observations on Naval Architecture by "An Observer," who, in my opinion, is not a *practitioner*. He complains of the little improvement made by builders in the construction of ships and vessels, respecting breadth and draught of water. Now, it is well known that no vessels answer their helms better, sail faster, or allow of a heavier pressure of sail, than those that have been increased in breadth and depth; witness the Gravesend and Sheerness passage-boats, Dover cutters, and fishing smacks, all which have a greater depth and breadth, in proportion, than any other vessels round the coast—that is to say, from nine to ten feet draught of water, and from fifteen to sixteen feet beam, measuring from 50 to 60 tons. These are facts, which fully demonstrate that Mr. Observer's observations are mere delusions, or, as appears by some of his propositions, originate in a want of knowledge of the art. See particularly what he says of lengthening a vessel by the head, page 184.

If I may be permitted to give an opinion, from the ending of Observer's letter, in reference to Mr. Major's abilities, and the ending of the Old Lieutenant's letter, Number 126, page 221, in recommending the young chaps from the College to lead us through the darkness we are *benighted with*, they were schoolmates of the College, or one and the same person.* As an old practitioner, I would advise them to put themselves under the tuition of an old shipwright. Perhaps, in a few years, when time and experience have improved their understandings, and made them a little wiser in the practical part of naval architecture,

* Certainly not one and the same person.—Edit.

they will be able to produce better specimens than what they have yet done. Our Old Lieutenant observes in his letter, that he has been surprised to find how little information he could gain from the master shipwright on the nature and qualities of ships intrusted to him. Query, if the young chaps from the College will surpass the present builders, or ever arrive at that degree of knowledge in naval architecture, that the present principal artists are in possession of; witness Sir Robert Seppings; Builders—Stone, Canham, Parkins, Lang, &c. Happy am I to say, no country can boast of better shipwrights than England. I will ask our Old Lieutenant, Who has had the constructing and conducting the building of those bulwarks of Old England, but the very builders he is degrading?

It has been with me a subject of much surprise, considering the expense, and the time which has elapsed since the establishment of the College, that we have not had ships built surpassing in every quality those built by the *old chaps* in the days of darkness. Surely, ere long, we shall have one of those ships constructed, or the eyes of those who have the reins in their hands will be opened, and they will be induced to hold out some little encouragement to our young practitioners to thirst after that knowledge so advantageously to be derived from their forefathers' experience.

I remain, Sir,

Your obliged servant,

A Spectator.

Chatham.

INDIGO MILLS.

Sir,—In accordance with the desire of your Corespondent—"A Dyer," of Armitage, near Huddersfield,—I take the liberty of pointing out to him, through the medium of your instructive Magazine, what I consider as defects in his proposed new plan for an Indigo Mill.

The bottom of the pan being bevilled, the indigo will naturally fall to the lowest part, which will very much impede the working of the conical rollers, and prevent their having an equal and uniform bearing, and thus a considerable portion of each roller will be ineffective.

I would suggest the following improvements, viz. that the bottom of the pan be perfectly flat, the rollers cylindrical, and to work close to the upright shaft; on this plan, perhaps, it would not be convenient to have more than three rollers, as I would propose that the indigo pot be not more than two and a half or three feet in diameter, as I consider that it would be less expensive and more efficacious to erect two mills of the above sizes than one of the larger dimensions proposed by your Correspondent. The friction created by a cylinder working in a small circle would be advantageously employed, and render the weight of the roller more effective in grinding the indigo, of which any attentive observer may be convinced by inspecting a drug-mill, or a mill for grinding dye-woods. Indeed, the plan I have now suggested is a drug-mill in miniature, with the addition of another roller.

A similar plan to the above I gave some years since to a blue-dyer in this neighbourhood, and he has found it to answer very well; and I have heard that a second mill, upon the same plan, has been erected in consequence.

I am, Sir,

Your obliged servant,

Not a Dyer.

Bowbridge, near Stroud,
February 6th, 1826.

CALLING THE HOURS.

Sir,—I know not any way in which I can submit to the public a matter of regulation productive of considerable convenience, without any additional expense, than through the medium of your valuable publication, and I therefore proceed to state the difficulty experienced in distinguishing the sounds issued by watchmen composed of Scotch,

Welch, and Irish, as well as provincial English individuals, and who are perhaps induced to utter the cries of the hour with an affected twang like the cries of commodities offered for sale. I would therefore entreat the gentlemen superintending this department to direct the watchman, after twelve o'clock, to repeat the precise numbers like the sound of the strokes of a clock, in alternate succession, with the aggregate of the number, so that each might render the other more clear and intelligible: for instance, "one, two, three, past three o'clock;" "one two, three, four, five, six o'clock, past six o'clock," and so on, *mutatis mutandis*; so that the hour may be, as it were, struck as well as sounded, and the present jargon avoided.

I remain, Sir,
Your obedient servant,
ÆGROTUS.

February 6th, 1826.

GROWTH OF SILK—MR. BADNALL'S WINDING MACHINE.

SIR,—As experiments in the growth of Silk in this country are of the greatest importance, particularly now that the Ministers have expressed (wisely or not, I am not able to say) their determination to compel the country to enter into a contest with our formidable rivals in that article; and as it will require the greatest exertions on our part to meet the competition, I hasten, in answer to your Correspondent, J. S., page 242, to recommend him to apply to Mr. Heathcoate, of Tiverton, in Devonshire, who has been attending to the growth of silk and the mulberry in this country for some time past, and was, I believe, the original proposer of the new chartered Company for the cultivation and growth of Silk in the united kingdoms and its settlements. Mr. H. is now in France, but is expected back in about ten days from this date; when he returns, I am sure he will feel great pleasure in supplying Mr. S.'s wants. If you have no objection, I will endeavour (in a future communication) to draw the attention of persons residing in the country to the advantages which may be gained by attending to the growth of silk, particularly now that they can so easily get the cocoons properly reeled at Mr. Heathcoate's factory.

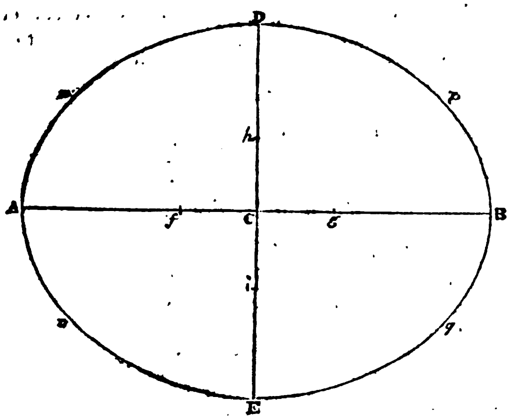
I embrace this opportunity of correcting an error which you have been led into, respecting a silk-winding machine, for which a patent was granted to Mr. Badnall a short time ago. Now, I have the strongest reason to think, indeed I feel fully satisfied, from information nearly direct from the parties themselves, that Mr. Scott is the real inventor. If so, he, and he alone, has a right to the credit of it. Now, I am one of those who think the public are bound to see justice done, as far as possible, to the abilities of every honest, industrious, working mechanic, who, from his situation in life, or some other cause, has not an opportunity of contending with the more wealthy patent manufacturer and dealer (for, Mr. Editor, there are patent dealers as well as other dealers). Now, why Mr. Abbot (who is Mr. B.'s patent agent) should so earnestly come forward to claim, in this public manner, Mr. Scott's *sole* invention as Mr. Badnall's, he alone is able to state, and I hope he will; and if he wishes it I will give him and the public a short history of the transaction, as it has been handed to me, and which will, I think, "put the saddle on the right horse."

I am, Sir,
Your obedient servant,
H. JONES.

Cheapside, Feb. 7, 1826.

[We shall be glad to hear again from Mr. Jones.—EDIT.]

THE NEW METHOD OF DESCRIBING ELLIPSES.



SIR,—On reconsidering the method of describing Ellipses, which I transmitted to you, and which appeared in page 249 of your present volume, an improvement has suggested itself to me, which, by superseding the necessity of reference to any table, materially simplifies the second case of the problem, or that wherein the two axes are given to describe the curve; and as the problem is one of considerable practical utility, I trust it will be a sufficient excuse for my troubling you with the following amendment, commencing with the words

CASE II.

To describe an ellipse, the transverse and conjugate axes being given.

Rule.—Having drawn the two axes at right angles with each other, and intersecting in their common centre, multiply the difference between the two semiaxes by 1.707, and you will have the extent, C*f*, which is to be set off from C to *f*, *g*, *h*, *i*. Place one foot of the compasses on *f*, in the transverse axis, open the compasses until the other foot falls on A, the nearest extremity of that axis, and with this radius describe the quadrant *mn*; in like manner, with the centre, *g*, describe the quadrant, *pq*; then place one foot of the compasses on *i*, in the conjugate axis, open the compasses until the other foot falls on D, the remotest extremity of that axis, and with this radius describe the quadrant, *mp* (which must meet the two quadrants already drawn); repeat the operation on the other extremity of the conjugate axis, and the ellipse will be completed.

Note.—The multiplier 1.707 expresses the side of a square, added to half its diagonal; or it is unity added to half the square root of the number two.

If the two axes of the ellipse be given geometrically instead of arithmetically, the extent, C*f*, may be found thus:—Take the difference between the two semiaxes, AC, CD, in the compasses, and set it off from the centre, C, towards *f* and *h*, which will give two points, *x*, *y* (not exhibited in the diagram); increase C*x* by half the diagonal, *xy*, and you will obtain the extent, C*f*, as required.

It may be proper to repeat the remark, that this method of describing ellipses is proposed as a general rule of sufficient practical accuracy, only

in such cases wherein the conjugate axis is not less than three-quarters of the transverse; for in ellipses of greater eccentricity it cannot be depended on: the most pleasing form of the curve is, however, within this limit; probably it is that wherein the proportion of the axes are as five to four, in which case the measure of *Cf* is about one-third of the semi transverse axis.

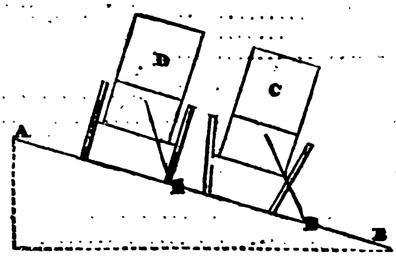
I am, Sir,

Your most obedient servant,

M. SMITH.

Feb. 7, 1826.

CONICAL WHEELS.



SIR,—You would much oblige me by inserting the following addition to the letter of F. O. M., page 101, Number 119.

Let us suppose AB the side of a hill, upon which C, a cart with the old wheels, and D, one with the new, loaded equally, and of a corresponding size, are placed, the centre of gravity being therefore the same in both. Now, it is evident that the line of gravity, E, will fall outside the wheels of the old cart, and inside those of the new, thereby rendering the cart, C, considerably more liable to overturn. The result of the comparison is obvious.

I remain, Sir,

Your obedient servant,

M. H. SHUTTLEWORTH.

Tottenham, Jan. 2, 1826.

IMPROVEMENT OF LIGHT-HOUSES.

It has been suggested that Light-Houses might be improved by adding one or more lights below the large light; for example, one at fifty feet below it, and another at one hundred feet below it. The object of this addition would be to enable an observer at sea to determine the distance of his vessel from the light-house. So long as the first of the lights below the great light is below the horizon, the distance may be concluded to be considerable; and when it can be seen, there being a known distance between the two lights, the distance of the vessel may be easily computed, if the angle subtended by the two lights be measured. Every proposal for the improvement of light-houses ought to be examined, in consequence of the importance of these buildings to a commercial country such as ours. The present suggestion, though good, is perhaps not of a nature to be adopted in practice without involving some difficulty, for the lower light ought to be seen in every direction, and in the same vertical line as the upper one. These conditions are not easily obtained. Perhaps the best mode would be to make the lower light revolve round the light-house: and it is essential that the lower light should be as distinct as the upper one; otherwise it might occasion serious errors in hazy weather.

RESULTS OF A METEOROLOGICAL JOURNAL, FOR JANUARY, 1826.

Kept at the Observatory of the Royal Academy, Gosport, Hants,

BY DR. BURNEY.

		Inches.			
Barometer	Highest	30.51,	January 17th	—Wind	S.
	Lowest	29.54,	6th		N.E.
Range of the Mercury		0.97.			

	Inches.
Mean Barometrical Pressure for the Month	29.980
——— for the Lunar period	29.693
——— for 14 days, with the Moon in North declination	29.671
——— for 16 days, with the Moon in South declination	29.715
Spaces described by the rising and falling of the Mercury	3.550
Greatest variation in 24 hours	0.340
Number of changes	21

Thermometer	Highest	49°,	January 31st	Wind	S.W.
	Lowest	17	14th		E.
Range		32			

Mean temperature of the external air	35.56
—— for 29 days, with the Sun in Capricornus	34.21
Greatest variation in 24 hours	17.00
Mean temperature of spring water at 8 A.M.	50.10

DE LUC'S WHALEBONE HYGROMETER.

	Degrees.	
Greatest humidity of the Air	93	in the evening of the 30th.
Greatest dryness of ditto	59	in the afternoon of the 9th.
Range of the Index	34	
Mean at 2 o'clock P.M.	74.0	
——— 8 o'clock A.M.	80.1	
——— 8 o'clock P.M.	78.9	
Mean of three observations each day, at 8, 2, and 8 o'clock	77.7	

Evaporation for the Month	1.000 inches
Rain in the Pluviameter near the ground	0.890
Rain in ditto 23 feet high	0.825

Prevailing Winds, N.E.

A SUMMARY OF THE WEATHER.

A clear sky, 5; fine, with various modifications of clouds, 10; an overcast sky, without rain, 12; foggy, 1; rain, 3.—Total, 31 days.

CLOUDS.

Cirrus,	Cirrocumulus,	Cirrostratus,	Stratus,	Cumulus,	Cumulostratus,	Nimbus.
11	8	27	1	9	20	13

A SCALE OF THE PREVAILING WINDS.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Days.
3	10	3	4	3	2½	½	5	31

The first part of this month was fair and frosty, with the exception of two or three days; and the latter part very damp and humid, with variable winds from the east side of the meridian. The frosty weather was ushered in by a N.E. wind, which blew strong from that point nearly seven days; it then shifted to the N. and N.W., with a low temperature till the 13th instant, which was the coldest day and night we had had since the 15th of January, 1820. Here the thermometer in the external air, at 7 o'clock A.M. on the 14th, was as low as 17 degrees; in London, on the morning of the 16th, it sank to 15 degrees; and in Paris it was said to have receded several degrees lower. In the morning of the 8th, all the pumps that were not under cover were ice-bound, and continued so nine or ten days. On the 9th, the skaters assembled upon the ice in Stoke's Bay Marsh, and upon the moat round the fortification of Gosport, where they amused themselves and the bystanders eight or nine days; and as the weather was calm, clear, and frosty, a favourable opportunity presented itself to those *patineures* who were anxious to acquire the art of displaying graceful *evolutions sur la glace*.

The Newspapers recorded many melancholy and fatal accidents having occurred in various parts of the country, from the want of caution in pursuing this elegant amusement before the ice was sufficiently strong to bear.

In the morning of the 15th there was an apparent change in the atmosphere, when three winds prevailed simultaneously, viz. the lower one from the East, the next from the S.E., and the upper one from the N.W., with a rising temperature, which continued till the 21st, when the external thermometer rose to 46 degrees; but the lower wind being dry, the barometer rose steadily till the evening of the 17th, and on the 18th the frost went off, succeeded by drizzling rain. A more favourable thaw could not have been desired, as it was remarkably gradual, attended with scarcely sufficient rain to wet the ground, and the thick masses of ice had not entirely dissolved into a fluid state till the close of the month. Here we had not enough snow to cover the ground, but in the northern parts of the country it was several feet in depth, so that the stage-coaches could not pass for some days. In Paris, too, it was nearly a foot in depth, which was deeper than had been known there for some years past. The change in the atmosphere, from a very cold and dry state to a considerable increase of temperature and great dampness, was attended, as usual, with colds, coughs, and rheumatism; the weather, however, was seasonable and healthy till the full of the moon.

A few minutes after sunset on the 9th, there appeared round the horizon a dark purple haze, with an even altitude of about five degrees; next to this was a band of red, 2½ degrees wide, surmounted by a yellow band of the same width. The primitive colours thus forming contiguous bands near the horizon, but brighter diametrically opposite to the sun, had a fine appearance, and were produced by reflection of the sun's horizontal rays, from the falling frozen dew or descending hoar-frost.

The atmospheric and meteoric *phenomena* that have come within our observations this month, are one parhelion, one solar and three lunar halos, two meteors, and six gales of wind, or days on which they have prevailed, from the N.E.

SHELDRAKE'S INCLINED PLANE WHEELS.

SIR,—I shall feel obliged if you, or any of your Correspondents, can inform me the reason why the Inclined Plane Wheels of Sheldrake, for which the patent has expired, are not used, and seem almost unknown. One defect I can see clearly, that as the rubbing (or rolling, as some are pleased to call it) is confined to a small part of the surface at the time, that part will yield or wear very soon, particularly in heavy work. I am quite aware of the extravagant pretensions with which they were brought out, but still there might be some corn with the chaff.

I am, Sir,

Your obedient servant,

S. E. ASH.

17, George-street, Walworth.

XTRAORDINARY ACCURACY OF A SCALE-BEAM, AND EFFECT OF A SLIGHT HEAT UPON IT.

Sir,—The Mechanics' Magazine being a useful depository of Arts and Sciences, I send, for the amusement if not for the edification of its readers, the result of an examination and experiment made this evening upon a scale-beam at Mr. De Grave's weight, scale, and measure manufactory, St. Martin's Le Grand. In order to give some idea of the astonishing accuracy of the beam examined, it may be necessary to state that it was one of the large size, weighing about a stone, horseman's weight.

Mr. De Grave, for my satisfaction, first put into one of the pans of the balance *half a grain*, which presently produced a preponderation, the beam forming an angle with the horizontal tangent of about 20 degrees. Upon changing the weight (*half a grain*) to the opposite scale, the counter-preponderation was produced with the same regularity as before; and until the weight was removed, no other oscillation or equilibrium was produced; but when the weight was taken out of the pan the equipoise was perfect. With this I could not be otherwise than thoroughly satisfied; but as Mr. De Grave had occasion to write a few lines, with his back turned towards the beam and scales, I took advantage to make an experiment unobserved, which, but for such an opportunity, I did not feel assured he would have permitted. I accomplished my experiment in less than two minutes, and then drew the attention of Mr. De Grave, telling him to look at the fallacy of his beam, which was preponderating without any weight at all. He was, however, too confident of their accuracy to be at all shaken by this appearance, although he looked for a considerable time, without any visible change in their oblique position. He then charged me with having done something to it.

I admitted that the equipoise had been destroyed by an experiment which I had made. He requested me to state what it was. I left him to guess a little; when, after a moment's reflection, "You have applied the candle to the beam," said he. "Just so," rejoined I. Finding him guess the real cause so readily, I asked if he was aware that so sensible an effect could have been produced in so short a period in this manner? He replied in the negative; and taking the candle himself, applied it to the opposite arm, at about the midlength between the end and the point of suspension,* as I had done with the other. One arm was now contracting, and the other expanding, and the oscillation was presently completed. Mr. De Grave then, filled with satisfaction at the result, ejaculated—"You have made an important discovery for me!" Continuing—"I have been frequently in the practice of adjusting my weights in this machine, sometimes by day, and sometimes when a lamp has been within a foot of the end, and always found, on re-examination, there was a difference in the weights, between those done when the lamp was lit, and when not lit, which, until now, I never could account for."

Conceiving this matter to be not altogether unworthy of notice at the present moment, now that accuracy in weights is properly appreciated, I send it to you for insertion in your Magazine.

I am, Sir,
Your obedient servant,
Wm. Gutteridge,
Conservator of Weights and Measures for the County of Middlesex.
21, Drummond-street, Euston-square,
February 8th, 1825.

* The part of the beam where the candle was applied is two inches and a quarter width, and nearly half an inch thick.

DIFFERENT ILLUMINATING POWERS OF STRAINED AND UNSTRAINED OIL.

Sir,—To your very useful and interesting publication I have been an original and constant subscriber, and have to thank it for many hints which have proved very serviceable to me in the adoption—I therefore owe it much. In part payment thereof, I beg to notice a trifling occurrence which has lately come under my immediate observation, for which I cannot satisfactorily account, and which I do not remember to have seen any where noticed.

I am in the constant and nightly habit of burning one of the sinumbra lamps, as I very much prefer its light to that of a candle. I use the best sperm oil that I can obtain. Last Spring, having nearly consumed the supply which I had provided for the Winter's use, and finding that, towards the bottom of the can, the oil was become thick, and would not burn with so good a light as heretofore, I strained that which remained through a thick flannel, which operation appeared to my eye only to remove the thick and feculent matter which it contained, the oil which passed through being perfectly clear and pellucid. This *strained oil*, to my astonishment, would not burn in my lamp. Thinking that the fault might rest with the lamp, and that, probably, it might want cleaning, I sent it up to town for that purpose; when it returned I again tried to burn the same oil, but without success: I then emptied the lamp and introduced a supply of *unstrained oil*, which burned as well as I could wish. Since then I have given the strained oil to my servants, to burn in the stables in a common open tin lamp, with a common cotton wick: they too failed in being able to make it burn, the flame dying away as soon as the wick had burned for a few seconds. The *rationale* of this I wish to account for.

I am, Sir,

Yours respectfully,

Agricola.

UNDER-DRAINING.

Sir,—I am the unfortunate son of one who has spent or (in his own words) buried his whole fortune under-ground, in the practice of Under-Draining. He made use of under-drains as a *substitute* for water-trenches, and considered that a drain placed four, five, or six feet under ground, though nearly the whole depth in clay, would not only drain the ground immediately above it, but that the water, for many feet each side the drain, would soak slant-ways into it, so that, in a field of twenty acres, perhaps there would be as many under-drains. Now to the point—is this not an erroneous view of the system, upon principles drawn from common observation?

As I am a lawyer, not a farmer, I can say nothing myself; but as I lately observed that a large drain under a garden walk, in light ground, four feet from the surface, had no effect, and that another drain, only six inches under ground, was found necessary to drain that walk, it led me to doubt the correctness of the first part of my relation's theory; and, as to the second part, it seems that if the water could soak through into the drain, it would not do so fast enough, and that the water cannot so drain off, for, if you observe in digging clay, there are small holes in a perpendicular direction. Are these worm-holes, as is commonly thought; or are they the natural drains of the earth?

These are only a few loose thoughts—I know nothing of the subject; I have not considered it generally, nor the enormous expense attending it, nor have I spoken of the extensive benefits that have been, and continue to be, derived from under-draining by more accurate observers. I wish to be informed whether the use of an under-drain is not to carry off water already drained, and not itself to drain the land, by acting as a substitute for the water-trenches?

I am alluding to the middle of Buckinghamshire, where, of a large farm, many of the fields will generally be lower than others, but the

land is not by its nature too wet, but only liable to floods in wet weather. Now, it strikes me that the proper mode of draining such land would be by water-trenches, and an under-drain here and there only, where absolutely necessary to carry off the water already drained from the trenches.

I wish to be informed, also, whether under-draining, on the principles first mentioned, might not be prejudicial to the land, by so many drains drawing out the proper moisture of the earth, in dry as well as wet weather, for it has been observed, that the crops of my relation are not so good as formerly; that his land has been more cracked in hot weather than his neighbour's; and that a field of grass under-drained in this manner entirely failed one summer, apparently from the dryness of the ground, which was cracked all over, though it was a field of old sward, surrounded by a stream of water.

I am, Sir,

Your obedient servant,

FERMOR.

CRANE'S MARINE LIFE-PRESERVER.

SIR,—To remove the doubts from the minds of your Correspondents, I beg leave to trouble you with a few lines to explain the origin of the Marine Life-Preserver. In January, 1798, the Royal Humane Society offered a premium for the best essay on the means for preserving the lives of shipwrecked mariners, &c. (particulars you may see in their report for that year). In consequence of this I sent them a hamper of models, consisting of a method for keeping a vessel afloat; also a sailor's chest that could be made water-proof in two minutes, to preserve ships' papers and valuables; also a method to prevent boats from sinking if full of water; also the marine life-preserver, with a few others. After an investigation by the Lords of the Trinity House and the Committee of the Royal Humane Society, an honorary premium was voted me, particulars of which you may see in the Society's Report for 1799. I had an interview with one of the Committee, and expressed my surprise that it was not made more public, and I was informed that it was improper at that time, as there were a great many pressed men on board the ships of war, whom this invention would enable to make their escape. A drawing and description of the life-preserver were published in the Evangelical Magazine, October, 1820, and again in the Norwich Mercury, September 10th, 1825, with remarks by the editor, and a determination of the Norfolk Association to recommend the plan. I have the original drawing by me. If you have room in your columns, some future time, I may describe the chest and boat. The chest will require a clever workman to make it; the boat is a simple addition to the common boats in use. By inserting this, you will greatly oblige,

Sir,

Your most obedient servant,

ROBERT CRANE.

New Mills and Water Works, Norwich, January 28th, 1826.

ASTRONOMICAL RESULTS, DEDUCED FROM NEWTON'S PRINCIPIA.

BY W. SHIRES, MATHEMATICAL TUTOR.

To find the distance betwixt the centres of the Earth and Moon.

Find, betwixt the tropics, the distance which a body will fall during the first second of time, which multiply into the earth's diameter, and also into the square of the moon's siderial periodic time, and divide this product by the square of the circumference of the earth; then find the cube root of this quotient, and multiply this root into the earth's radius, and it gives the distance sought, which will be in feet or miles, or in whatever terms you take all the quantities in.

If we have the proportional distances of the sun and moon, then we may find all the distances, magnitudes, gravities, densities, and pe-

riodic times; for, in the same system, the squares of the periodic times are constantly proportional to the cubes of their mean distances from the common centre, whose roots will be the times and distances.

In the same system, the areas generated by the radii of the orbits are directly proportional to the square roots of those radii, or to the periodic times divided by their respective distances; and the velocities in the orbits will be inversely proportional to either.

To find the quantity of matter in Jupiter and Saturn.

Cube the distance of one of Saturn's moons from the centre of Saturn, and divide this cube by the square of its periodic time; do the same with Jupiter and one of its moons; also the same with the earth and our moon; then those three quotients will be to each other as the matter in Saturn, Jupiter, and the earth respectively: and if those quotients be divided by the cubes of their respective diameters, this gives their densities; and the matter divided by their respective densities will give the proportional spaces filled by each, viz. by Saturn, Jupiter, and the earth respectively; then, since we know the magnitude of the earth, whence making a proportion with it, and spaces filled by Saturn and Jupiter, will give the actual spaces filled by Saturn and Jupiter respectively, from which their diameter may also be calculated.

INQUIRIES.

NO. 179.

CAPACITIES OF STEAM-ENGINES.

Sir,—I should feel much obliged if any of your practical Correspondents would favour me with some information as to the power of the following steam-engines for raising water:—

A 30-horse double-power condensing engine—cylinder, 30 inches diameter—length of stroke, 4 feet—16 strokes per minute—depth of pump-well, 36 feet—diameter of pump, 16 inches.

A 40-horse double-power condensing engine, with the same particulars as above, except that the cylinder is 33 inches diameter.

What quantity of water should each engine send per hour to receptacles, the height of which are severally 60, 120, and 140 feet above the land where the engine is situated, and at a distance of one mile and a half, through an iron main or pipe of 9 or 12 inches diameter, and which diameter of pipe would be most advisable for the benefit of the engines, considering the size of the pump? or should the diameter of the main be equal to or more than the diameter of the pump?

I should like to know the principles on which the quantities to the different heights are calculated.

Each engine, when at work, is supplied by *two* boilers, each of which is calculated for a 30-horse engine, but only one engine is employed at a time.

What should be the consumption of coal for each engine for 12 hours in performing the work?

By inserting this in your useful publication, you will oblige,

Sir,

Your constant reader,

A Distant Inquirer.

NO. 180.

VENETIAN WHITE ENAMEL.

Where can Venetian White Enamel be procured, such as is in general used by our best enamel portrait painters? I believe it is made by Miotto. Amicus.

ANSWER TO INQUIRY

NO. 224.

BORING FOR WATER CONSIDERED PREFERABLE TO PURIFYING WATER.

Sir,—Presuming, in answer to your Subscriber's inquiry, in page 224, Number 126, that he would

prefer always having a full supply of good water, to instructing him how to purify bad water (which instruction I leave to others to give him), I offer him advice which I have no doubt will not only prove highly beneficial to him, but worthy of the attention of thousands who are nearly similarly situated—that is, to employ a person who is proficient in boring, who will perforate, if necessary, through stones, gravel, flints, quicksands, and land-springs (which produce the water in the well he alludes to), and procure him good water through a tube, which will shut out all foul water, &c. and enable him to have, instead of 20 or 30, 100 or 200 gallons per day, raised four or five feet above the surface of the earth, which can be done by contracting the top of the tube. He may then preserve any quantity of that water pure and wholesome, by having a reservoir or basin, of any diameter, erected on the surface of the ground, about two or three feet high, with a wall nine inches, or one brick thick, cased on the bottom and sides with composition, which will, by being constantly wet, become as hard and durable as stone; leaving a plug-hole close to the bottom, whereby the water may be run off, and the basin cleansed occasionally. I adopted the above plan, in part, about fourteen years ago, by employing a person fully competent to the business, he being a bricklayer, well-digger, and borer, who turned a rivulet of water, a distance from my residence, into a small basin, for my own use and that of several families. From this basin he laid a brick drain, to convey the superfluous water across the back premises to a larger basin, which I had made for my ducks to swim in, at the top of which an opening was left to let off the superabundant water into a foul ditch adjoining, which in a short time cleansed the ditch, and kept several ponds, at the corners of fields below, fully supplied. The whole expense attending it did not amount to twenty pounds. Since that, I have devoted a deal of time in viewing the operation of boring [illegible] my great gratification; and if you should deem this communication worthy of a place in your valuable and widely-circulated Magazine, I shall convey to you for insertion a number of instances of water being obtained, in different counties, by boring from 50 to 400 feet deep—some through shingles, gravel, quicksands, land-springs, salt water, and rocks, with different quantities produced, one of which was 112 gallons per minute. I shall also give you the names of the persons, and their residences, where those supplies have been obtained; and as I have no personal interest, *nothing* but universal good in view, I have no doubt but your readers will give the subject a minute consideration, and that the process of boring will be generally tried, and so fully approved of, that the nobility, gentry, and opulent, will cause a copious supply of water to be obtained in every village and place, so that the poor may not have to go miles to obtain it. Such is the fervent wish of,

T. W.

Clerkenwell.

TO CORRESPONDENTS.

Montis, Jun.'s paper was unfortunately in print before his last favour reached us.

T. P. shall have a place.

We recommend to Phinta to continue his labours.

Communications have been received from Eclipticus—T. S.—M. de C.—Mr. Abbot—Aurum—W. C—r—Yes—A. W—A Somersetshire Dyer—T. M. B.—Mr. Smith—Fides Defensor—A Tyro at Tring—Y. Z.—B.—X. T.—T. B.—F. R. B. jun—W. W. H.

**** Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th of each Month.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

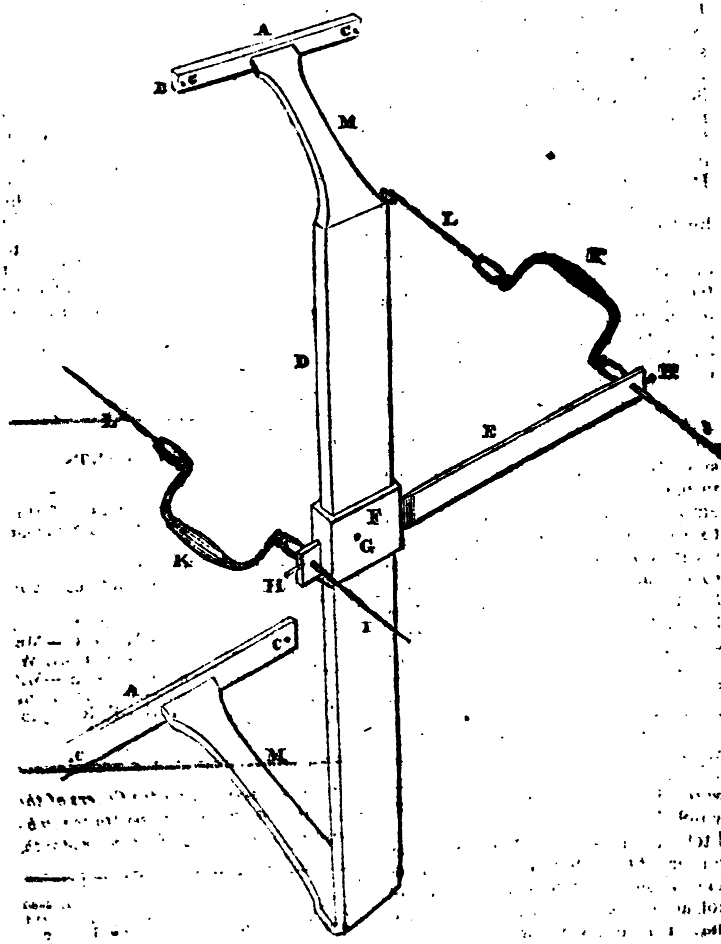
Printed by *Mills, Jewett, and Mills* (late *Bensley*), Bolt-court, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 131.] SATURDAY, FEBRUARY 25, 1826. [Price 3d.

ANNESLEY'S BORING MACHINE.



ANNESLEY'S BORING MACHINE.

(To the Editor of the Mechanics' Magazine.)

Sir,—The prefixed Machine was invented in the year 1822 by a Mr. Annesley, a native of Belfast, in Ireland. Its value to ship-builders, for expeditious boring, needs no comment.

I am, Sir,
Your obliged servant,
Anti-Sophos.

Description.

AA, Annesley's direct and uniform Boring Machine for two men.

B, flaunches, to extend a foot or more, to keep the machine steady.

CC, Holes to receive a taper wood screw, to fasten the flaunches to the side, deck, or bottom of the vessel, for boring.

D, upright bar, 7 feet high, 4 inches wide, and 5-8ths thick.

E, moveable cross bar, 3½ feet long, 3 inches wide, and half an inch thick.

F, clamp, that receives and carries the cross bar.

G, a screw to press the upright against the cross bar, to prevent its sliding when boring.

HH, leading screws passing through the end of the cross bar into the smooth collar, with points entering the progressive screw.

H, the progressive screws, cut close or open, according to the size of the boring bit, and quality of the wood; but all made to fit the same collar or pod in the stock; the outside of the thread is square, to move easily and steadily in the smooth collar.

KK, stocks.

LL, boring bits of all sizes, made to fit the same stocks.

MM, the arms rounded, allowing the hand on the stock to work as near as possible without injury. If the stock occupy 12 inches, the length of the arms must be 20 inches for boring 8 inches. For deeper boring, the machine must be proportioned.

SPILSBURY'S TANNING PATENT.

Sir,—Your insertion of my last letter in the Mechanics' Magazine, leads me to expect the same obliging attention will be shown to my present communication, more particularly since it is one calculated to benefit others and the public at large, as well as the patentee whom I represent.

This valuable discovery, whilst it is spreading in the Northern and Western Counties, is neglected by the tanners in and near the metropolis, and these latter make three-fourths of the sole leather manufactured in England. They neglect the patent, I humbly conceive, either because they are uninformed of its effects, which the publication of this letter will describe, or because they have large capitals laid out in premises, buildings, pits, &c. &c., two-thirds of which are not required under the patent process to produce the same quantity of leather. The trade, as it is now carried on, requires great command of money, consequently small manufacturers are kept out of it, or, if they rashly venture into the current, are swamped.

The observations I could offer on these premises will readily suggest themselves to the attentive reader; I proceed, therefore, to state briefly what the new patent will effect:—

Five hundred pounds will fit up a tannery with frames, pipes, tanning receiver, and steam boiler, equal to cure forty hides per week.

The time requisite to convert the hide into leather under the new process is one week; under the old it is five months, and in some cases more.

The space occupied for tanning, under the patent, is about one-fourth of what is required under the system of immersion.

The hands required to work a tannery under the new process are considerably fewer, for the skins are always in view, and their gradual conversion into leather can be observed without the necessity of pumping the liquor out of the pit,

of drawing the skin out of the liquor.

When the two hides (the number contained in each frame) are fixed in the frame, the tan-liquor is turned on by a cock, and no further operation is requisite till they are made into leather.

In these times of difficulty, which are daily compelling men of business to withdraw from trades requiring the application of extensive capitals, a better alternative cannot perhaps be suggested to such than the preparation of an article of general consumption and never failing demand, upon an improved and highly economised principle.

I shall be happy to give further information to any applicant who may think proper to make inquiry of me.

I am, Sir,

Your humble servant,

And constant reader,

PETER H. ABBOTT,

Agent to the Tanning Patentees,

2, Walbrook-buildings.

Walbrook, 14th February, 1826.

NEW BUILDING MATERIALS.

SIR,—The following novel method of building was practised some little time since by a bricklayer, who was then a resident near this town, and was afterwards adopted by several individuals. It may perhaps be followed with advantage in other places, where the materials required are more plentiful than those which are more costly and more in common use. The erections here are some respectable cottages, an extensive garden wall, and a malting. The materials required are—gravel, some sand, straw, and a proportion of lime, just sufficient to make them bind together. The whole are well mixed together, and formed into blocks in moulds, made of 1½ inch oak, well seasoned and strongly bolted, to resist the great pressure in filling. The moulds are made on one side somewhat larger than on the other, in order the more easily to discharge the lump when moulded. For 9-inch work the lumps are made 14 or 15 inches long, and rise 9 inches high. A mould is also used for making some of half the length, to be used alternately at the quoins, for the purpose of breaking the joints: smaller moulds are used for partitions. A strong table is also prepared to mould upon, and the mould is fastened to the table by iron clamps. A quantity of the prepared materials being placed upon the table, about a third of what is sufficient to fill the mould is then put in, and with a good rammer is well rammed down; the surface of the first and second ramming is jagged with a trowel, that the parts may the better unite. When the moulds are formed they are discharged upon a board laid for the purpose, and taken to a place prepared for drying, placing them about two inches apart, to admit a free current of air between, in a similar manner to bricks. If placed in the sun, and kept carefully from rains, they will be sufficiently dry for use in about ten days or a fortnight. The foundations and chimneys are built of bricks, as it is very difficult to cut these lumps to any smaller size than that which they are moulded to. When used, they are bedded in coarse mortar, and plastered over on both sides, to finish. The cost, I am informed, is one-third less than that of bricks, independent of their not being subject to any duty. Though the plan appears to have answered every purpose, yet, for some reason or other, it seems to have been abandoned, and I know of no other cause than that we are situated in the immediate neighbourhood of plenty of brick-kilns.

Should any Correspondent wish for any further information upon this subject, I shall take a pleasure in giving all that I can collect.

I am, Sir,

Yours respectfully,

W— C—

Maldon, Essex.

N. B.—A man may, with the assistance of a labourer, mould from 200 to 250 of these lumps in a day.

PRINCIPLES OF CHRONOMETERS.

From Dr. Gregory's excellent System of "Mathematics for Practical Men."

1. Clockwork, regulated by a simple balance, is inadequate to the accurate mensuration of time.

2. Clockwork, regulated by a pendulum vibrating in the arch of a circle, is of itself inadequate to the accurate mensuration of time.

1st. Because the vibrations in greater and smaller arches are not performed in equal times.

2ndly. Because the length of the pendulum is varied by heat and cold.

3. Clockwork, regulated by a pendulum vibrating in the arch of a cycloid, is inadequate to the accurate mensuration of time.

The isochronism of the vibrations of a cycloidal pendulum in greater and smaller arches, is true only on the hypothesis, that the pendulum moves in a non-resisting medium, and that the whole mass of the pendulum is concentrated in a point, both of which positions are false. For these reasons, the application of the cycloid in practice has been entirely relinquished.

4. Modern time-keepers owe almost the whole of their superiority over those formerly made to two things—

1st. The application of a thermometer.

2ndly. The particular construction of the escapement.

5. Metals expand by heat and contract by cold: this is proved experimentally by the pyrometer. Metallic bars of the same kind are found to expand in proportion to their length. Metals of different kinds expand in different proportions, thus the expansion of iron and steel are as 3, copper 4½, brass 5, tin 6, lead 7. Hence pendulum rods, expanding and contracting by the successive changes of temperature, affect the going of the clocks to which they are applied.

Various have been the contrivances to correct the errors of pendulums from their contraction and expansion by heat and cold; the principal of these are described under the subject of Pendulums, page 251.

6. The balance of a watch is analogous to the pendulum in its properties and use.

The simple balance is a circular annulus, equally heavy in all its parts, and concentrical with the pivots of the axis on which it is mounted. This balance is moved by a spiral spring called the balance-spring, the invention of the ingenious Mr. Hook.

7. The pendulum requires a less maintaining power than the balance.

Hence the natural isochronism of the pendulum is less disturbed by the relatively small inequalities of the maintaining power.

8. The spring's elastic force which impels the circumference of the balance, is directly as the tension of the spring; that is, the weights necessary to counterpoise a spiral spring's elastic force, when the balance is wound to different distances from the quiescent point, are in the direct ratio of the arcs through which it is wound.

9. The vibrations of a balance, whether through great or small arches, are performed in the same time.

For the accelerating force is directly as the distance from the point of quiescence; hence, therefore, the motion of the balance is analogous to that of a pendulum, vibrating in cycloidal arches.

10. The time of the vibration of a balance is the same as if a quantity of matter, whose inertia is equal to that by which the mass contained in the balance opposes the communication of motion to the circumference, described a cycloid whose length is equal to the arc of vibration described by the circumference, the accelerating force being equal to that of the balance.

Because in both cases the spaces described would be equal, as also the accelerating forces in corresponding points, and therefore the times of description.

11. If g denote the accelerating force of gravity, L the length of a

pendulum vibrating seconds in a cycloid; a the semi-arc of vibration of the balance, in the time of vibration, and F the accelerating force of the balance, then will T =

$\sqrt{\frac{a}{L \times F}}$.

12. Let ½ g be the space which a body falling freely from a state of rest describes in 1″, and $p = 3{\cdot}141593$ the circumference of a circle whose diameter is unity, then will T =

$\sqrt{\frac{p^2 a}{g F}}$.

In this expression for the time of vibration, the letter *a* denotes the length of the semi-arc of vibration; if this arc should be expressed by a number of degrees c^0, and *r* be the radius of the balance, then *a* will be = $\frac{p r c^0}{180^0}$; and this quantity being substituted for *a*, the time of a vibration will be T = $\sqrt{\frac{p\,3\,c^0}{g F \times 180^0}}$; let the given arc be 90°, in this case T = $\sqrt{\frac{p c r}{2 g F}}$.

13. If the spring's elastic force, when wound through the given angle or arc $a = 90°$ from the quiescent position, be = P; the weight of the balance, and the parts which vibrate with it = W, the distance of the centre of gyration from the axis of motion = *g*, then will T = $\sqrt{\frac{w p^3 g^2}{2 p r g}}$.

These are expressions for the time of a vibration, whatever may be the figure of the balance, the other conditions remaining the same as above stated. If the balance be an annulus or a cylindrical plate, $g = \frac{r}{\sqrt{2}}$, and the time of vibration T = $\sqrt{\frac{w p^2 r}{4 P g}}$.

14. The times of vibration of different balances are in a ratio compounded of the direct subduplicate ratios of their weights and semidiameters, and the inverse subduplicate ratio of the tensions of the springs or the weights which counterpoise them, when wound through a given angle.

15. The times of vibration of different balances are in a ratio compounded of the direct simple ratio of the radii, and direct subduplicate ratio of their weights, and the inverse subduplicate ratio of the absolute forces of the springs at a given tension.

16. Hence the absolute force of the balance spring, the diameter and weight of the balance being the same, is inversely as the square of the times of one vibration.

17. The absolute force or strength of the balance spring, the time of one vibration, and the weight of the balance being the same, is as the square of the diameter and the balance.

(To be continued.)

PRIZE CHRONOMETERS.

We omitted to mention, in our last Chronometer Report, that Barwise, No. 9294, and Webster, No. 710, were withdrawn during the eighth month; and it appears from the Ninth Report, now before us, that, at the end of January, eight more have been withdrawn, viz. Cotterell, No. 637; Cotterell, No. 647; Desgrange, No. 29; Finer and Nowland, No. 304; Jackson, No. 675; Lowden, No. 2; Porthouse, No. 6281; and Tayler, No. 602.

We subjoin the remaining twelve in the order in which they stand for the prize:—

	No.	
French	$\frac{20}{3912}$	2,63
French	976	3,54
Harris	618	4,24
Molyneux	862	4,79
Desgrange	35	6,46
Cathro	1703	8,40
Cathro	1685	8,99
M'Cabe	168	9,14
Ellicott	947	9,72
Jackson	512	9,76
Webster	638	10,47
M'Cabe	167	10,73

ENGLISH GRAMMAR.

Sir,—I hope neither you nor your readers will suppose, because I am somewhat minute in my definitions at the commencement of my undertaking, that I intend to pester you and them with a long and tedious treatise upon this science; such is by no means my intention. But I must say, that I like to see my horse well shod before I begin to travel, lest he should happen to slip a shoe, and occasion a delay which might prevent my arriving at the end of my journey as soon and as safely as I anticipate.

It is usual, after having explained what a *noun* is, to treat of the *adjective*; but as I am a friend to consistency, and as I have the example of some others on my side, I shall first draw the attention of your readers to

THE PRONOUN.

Pronouns stand in the places of nouns, and are used instead of them: thus, instead of my name, I say, *I*; instead of your name, I say, *you*; instead of his or her name, I say, *he* or *she*; and instead of the name of any thing without life, I say, *it*.

Pronouns are employed to avoid the tiresome repetition of the same word; for example, instead of saying, "Indolent people are enemies to literary improvement, because *indolent people* know that *indolent people* must be ultimately detected and exposed;" I say, "Indolent people are enemies to literary improvement, because *they* know that *they* must be ultimately detected and exposed."

And again; instead of saying, "Squire Loggerhead called on Mr. Dunderpoll yesterday, and told *Mr. Dunderpoll* that *Squire Loggerhead* was very much alarmed at the rapid advances towards improvement made by the working classes; as the *working classes* had already succeeded, under the auspices of Dr. Birkbeck and *Dr. Birkbeck's* friends, in establishing an Institution calculated to make the *working classes* as learned as the *working classes's* superiors;" I say, "Squire Loggerhead called on Mr. Dunderpoll yesterday, and told *him* that *he* was very much alarmed at the rapid advances towards improvement made by the working classes; as *they* had already succeeded, under the auspices of Dr. Birkbeck and *his* friends, in establishing an Institution, calculated to make *them* as learned as *their* superiors."

Here, by employing the pronouns *him, he, who, his, them,* and *their*, I avoid making too frequent use of the nouns *Squire Loggerhead, Mr. Dunderpoll, classes,* and *Dr. Birkbeck*.

The word *pronoun* comes from the Latin, *pro nomen, for a noun*; and the part of speech is so called, from its being used in the place of a noun.

There are in English only about forty pronouns; but these change their form in particular cases: thus,

I is sometimes changed	into *my, mine,* and *me*
Thou	into *thy, thine,* and *thee*
You	into *your* and *yours*
He	into *his* and *him*
She	into *hers* and *her*
It	into *its*
We	into *our* and *ours*
They	into *their, theirs,* and *them*; and
Other	into *others*, &c.

Who is in some cases written *whose*, and in others *whom*.

Which and *that* retain the same form; as do *each, every, either, this, that those these, some, any, all, such*, &c.

Whichsoever, whosoever, whatsoever, whichever, whoever, whatever, are pronouns but seldom used.

Whether is a pronoun, when it means which of the two.

Myself, yourself, himself, and *itself,* are pronouns; as also *my own, your own,* &c. although the words are not joined.

Hey day! this is a wild work indeed! says a brother grammarian, having the same object in view as myself. Good son of science, jog peaceably on in your own track, with your companions, and leave us to follow ours; we shall see who gets to the end of the journey first.

Let the learner once or twice more read over the foregoing pronouns attentively, and then proceed to pick out the pronouns from the few exercises I have subjoined, and from any book which he may have at hand.

Example.

A Jacobin's picture 'tis* easy to draw—
He can't bear to obey, but will govern the law.
His manners unsocial, *his* temper unkind,
He's a rebel in conduct, a tyrant in mind;
He's† envious of *those who* have riches and power,
Discontented, malignant, implacable, sour;
Never happy *himself, he* would wish to destroy
The comforts and blessings *which* others enjoy.

Examples for Practice.

I think those papers are mine; will you hand them to me for my inspection?

We expected you last Sunday; why did you not come to see us?

Those trees are ours; the fields adjoining are his.

If they are thine, I hope thou will take care of them.

Thou art the man.

He supposes that his uncle, who died lately, has left him a large fortune.

The knife is his; the scissors are hers; the book is mine.

They are the most beautiful flowers you ever beheld.

Give the books to them, for they are theirs.

Its beauty cannot be surpassed; who beholds it that does not gaze on it with pleasure?

The bird, which sang so sweetly, is dead.

The tree that bloomed so beautifully has been felled by order of its owner.

The man whose rapacious disposition destroys every thing.

To whom do I address myself? surely to him who feels for the distresses of his fellow-creatures.

Who is he, and which is the seat he is to occupy?

What are you doing with them?

My hopes and thine are inseparable.

I admire thy principles: when put in opposition to his, their superior excellence must appear to the most cursory observer.

Give him his papers; and tell her I will call upon her when our case is determined.

Your singing and their music conspire to afford us delight.

I am, Sir,
Your obedient servant,
WM. SMITH.

Castle-House Academy,
Guildford, Feb. 1.

COMPUTATION OF ECLIPSES.

SIR,—In reply to the question o "Amator Astrologiæ," in page 269, permit me to inform him that he will find instructions for computing eclipses in Ferguson's Astronomy; I would recomend him first to compute the time of new or full moon by the tables inserted in that work, and then to compute the longitudes of the sun and moon for that time by Vince's Tables; if they should not exactly agree (as will most commonly happen), let him find the hourly motion of each luminary, and thence their difference, which, having obtained, the time of the ecliptic conjunction may be found by the following proportion, viz. as the difference of the hourly motions is to one hour, so is the distance of the luminaries in longitude to the interval of time between the instant of computation and the true conjunction. Having thus obtained the time of conjunction, the longitudes, latitudes, parallaxes and semidiameters of each luminary must be computed for that time, and the necessary data will be had wherewith to project the eclipse in the manner prescribed by Ferguson.

Hoping this answer will prove satisfactory,

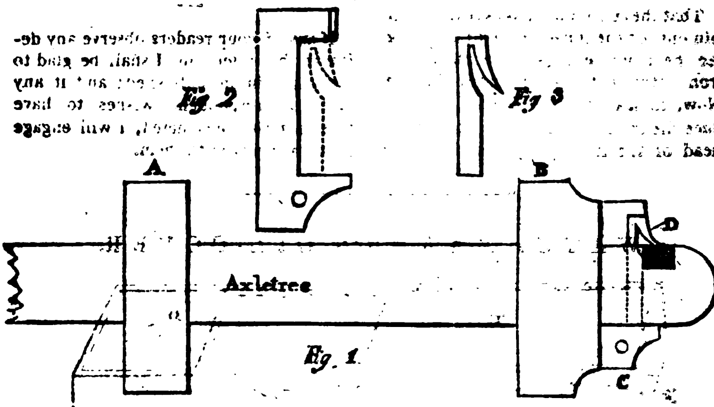
I remain, Sir, yours, &c.
ECLIPTICUS.

——, February 14th, 1826.

---

* It is. † He is.

SAFETY LINCH-PIN.



SIR,—As you have occasionally devoted some of your pages to the improvement of the Linch-Pin, which is of so much importance to those who commit themselves to the chance of its failure, I have of late devoted some attention to the subject, thinking that some of the plans by you laid down cannot be implicitly relied upon. In the course of my studies on this subject, I hit on the following plan, which, if it be worthy of a place in your useful Magazine, is devoted to your service.

I am, Sir,

Yours respectfully,

J. GRIMB.

Description.

The axletree has a collar, A, welded on it for the nave of the wheel to work against; the nut, B, is screwed on at the end of the axletree firmly, against a shoulder, which must be turned on the axletree before the screw is cut; this nut keeps the nave of the wheel in its place. It must be tapped on the right hand side of the carriage with a right-hand thread, and on the left hand or off side, with a left-hand thread; so that when the carriage moves forward these nuts will both have a tendency to tighten up, but which they will be effectually prevented from doing by the situation of the linch-pin and spring, in the manner shown by the figure, where C is the linch-pin, and D the spring. The linch-pin is made in the form shown at fig. 2, and the spring as fig. 3. Now, the spring being laid in the hollow of the linch-pin, as shown by the dotted lines, and the linch-pin forced into the hole of the axletree, which hole or slit they must exactly fit, and also a groove in the nut; it is evident that the nut can neither turn round, nor can the linch-pin possibly come out, because, as soon as the linch-pin and spring are forced into their places, the spring instantly opens, and flirts against the side of the small groove or dent which is made in the axletree for its reception (see fig. 1), from whence it will be impossible for it ever to return, until the end of the spring is forced back, or closed, by some power applied to it. Neither will the jolting of the carriage have any effect upon it, otherwise than to make it the firmer keep its place. This spring should be made of the best shear steel, and properly tempered (the gun-lock filers are the best spring-makers), and, when properly constructed, will last as long as the carriage. It cannot break when in its place, because it will then be at ease; and if it should snap in two when the coachman is putting it in, he must certainly know of it, and so get another fitted before he uses the carriage. It will be seen that this linch-pin may be used in the common way,

without a nut, and will still be as safe as with one, but the nut presents a better surface for the nave to act upon, and on that account should be recommended.

That the coachman may take the linch-pin out for the convenience of cleaning, &c. he must be provided with a small iron instrument, with a stud in the end. Now, to take out the linch-pin, introduce the small stud into the hole of the head of the linch-pin; then force the other end against the spring, and it will drive the spring back, so that the pin, spring and all, will come out in the usual way.

If any of your readers observe any defect in this linch-pin, I shall be glad to see his opinion published; and if any other Correspondent wishes to have axletrees so constructed, I will engage to furnish him with them.

WATCHMAKER'S OIL COVER.

SIR,—The oil which is in use by watchmakers is generally kept in a common watch-glass, contained in a small round box, with its lid made to slip on and off easily, in order that it may with the greater facility be covered again after using, to prevent its getting dirty; but certain it is, that the plan has not the desired effect, for when the workman uses it in a hurry (or indeed leisurely), he often neglects to put the lid on again, and thereby destroys the saving sought for. According to the plan above, the workman using his oiler as he would his pen, may, by pressing the little finger of the same hand on the end of the lever, F, lift up the lid and take out the oil as he requires: on taking away his finger the lid will drop down again as before, a spring being placed under that end of the lid nearest D. The square division, D, represents a piece of lead so attached to the box that it keeps it firm and steady, with a hole made in the middle, wherein common oil may be put to answer for common purposes.

I have made a cover of this description for my own use, and find it answer extremely well, not only as respects preserving the oil, as required, from dust, dirt, &c. but also as producing a great and material saving of time.

I am, Sir,

Your obedient servant,

JAMES S.

Huntingdon.

Description.

A, one of the pivots on the lid working through a hole on the sides of the box.

B, a pivot for the longest lever to work upon, which is fastened to the side of the box.

C, the same of the shorter lever.

D, a piece of lead attached to the end, that the cover may be used steadily without the assistance of the other hand.

E, is the lid under which is placed the glass containing the oil.

F is the part where the little finger is to be pressed to use the box.

This box may be made as portable as required: mine is (in all) about three inches long, half an inch deep, and one inch and a quarter wide.

N.B.—Will you be so good as to inquire, through the medium of the

same publication, the best and quickest method of cleaning off the old silver and lacquer from clock-dials which are intended to be re-done?

NEW MOTIVE ENGINE.

(From the Literary Chronicle, No. 353.)

SIR,—In this age of science, all its lovers will be happy in learning that they are soon likely to be favoured with a Motive Engine, which, according to present appearance, bids fair not to rival, but to outdo the steam-engine.

It may be in the knowledge of many of your readers, that some years since, that acute chemist, Mr. Faraday, discovered the means of condensing into a liquid state several of the gases, which had till then been considered permanently elastic or incondensable.

From the great atmospheric pressure and the low temperature necessary to preserve them in the liquid state, and their easy and sudden expansibility, it became evident to several ingenious men, that this circumstance, far from being a matter of curiosity only, might be converted to the most useful purposes as a moving force; exceeding in power any thing of which we had hitherto had any conception.

Many and various have been the modes resorted to by those engaged in experimenting in this arduous affair, to construct a vessel so impervious as to confine these highly attenuated gases.

Mr. Brunel, however, has at last succeeded in casting a cylinder in which to confine carbonic acid, this being the substance he has chosen for his operations; and he is so perfectly convinced of his success in his undertaking, as to have taken out a patent for a machine of this kind, and is now actually engaged in constructing one on this new principle.

Last night, at the conversazione at the Royal Institution, the members and their friends having withdrawn into the lecture-room, Mr. Faraday made known to them this highly interesting invention, and entered into a description of the machine, and the manner of generating the carbonic acid, and of elevating it into the gaseous state.

I wish I could give you as accurate a description of the machine as he did, but if I were able, my limits would not permit me. I shall do my best; but as it is quite new to me, I fear I shall be very deficient.

There are, then, as I understand, five vertical cylinders, the middle one having a piston, and performing the same part as the cylinder and piston of a steam-engine. But what moves the piston? I have said there are five cylinders. In the two exterior ones, the carbonic acid is confined, and is there alternately in one and the other expanded and condensed; operating at each alternation on the piston in the middle cylinder. The mode of operation is thus: several small tubes pass completely through the exterior cylinders, exposing a great surface to the liquid within, and by passing through these tubes alternately a hot and cold medium, the liquid carbonic acid is converted into the gaseous, and then the liquid state. Being elevated to the gaseous state, the pressure becomes immense; varying from thirty atmospheres and upwards many degrees. This pressure existing, there is a connexion from the upper part of the cylinder, by means of a tube, with another cylinder, which is situated between the generator and the one in which the piston moves; this middle cylinder is filled with oil, and communicates from the lower part to the upper or under side of the piston, according to the side on which it may be situated. On the surface of the oil is placed a thin piece of wood, fitted exactly to the interior of the cylinder; the gas now entering, presses upon the surface of the pieces of wood, forces down the oil, and so elevates or depresses the piston. I hope success will attend this invention.

If any thing can add to these rational conversaziones and lectures, it is the liberal manner in which the managers conduct them, and Mr. Faraday's pleasing manner of delivering his ideas to his audience, which is that of a man meeting an old and familiar friend whom he is heartily glad to see, and telling him all he knows.

Feb. 11, 1826. NAUTICUS.

VIATOR'S PERPETUAL PUMP.

SIR,—In reply to Viator, allow me to observe to him, that we must not put ourselves in a passion when we attempt to enter the Temple of Philosophy. Minds capable of calm and dispassionate reasoning, are the votaries on whom she turns her benignant smile. To them she gradually unfolds the wonders of her universal empire, expounds the simple but sublime system of the immutable laws of Nature, and patiently leads them, by the inductive path which the immortal Bacon pointed out and trod, through a long series of effects, up to their causes. If, Sir, such is indispensably the temper

of mind the demands of her votaries, I leave it to Viator himself to determine whether, from the character of his letter in your 127th Number, there does appear very fair *presumptive* evidence that he has been sent *empty away*. To offend your Correspondent was the furthest idea of my mind; he mistakes; 'twas his *pump* I attacked, in what was, according to his account, a Don Quixote style; *not himself;* he therefore might have omitted, without the least compromise of his dignity, either as a man or a philosopher, his "lie direct"—his "pert assertion"—and his "value not worth a rush." In his anger, he has gone so far as even to question the "honourable" character of the firm of Messrs. Montis, Jun. and Co.; and has fallen into the Hibernicism of declaring, that he "shall not deign to give them the *answer*" to "a question," which, he says, "they have *scorned to ask*." But as this sort of criticism, if carried beyond a certain limit, becomes foreign to the object of your work (however desirable it may be, that those who contribute to its pages should bestow not only some time upon the matter, but care as to the manner of expressing their ideas), I shall go no farther, but conclude with once more assuring Viator, that even now I am not at variance with him in feeling, but only in reasoning; and requesting, as I cannot comprehend how such a pump can act, that he will have the goodness to state at what place the pump in question is to be seen, at once for the pleasure and advantage of those who may be travelling in that quarter, and of,

Sir, your faithful,
But Viator's sceptical,
Humble servant,
Montis, Jun.

INDIGO MILLS.

Sir,—The plan proposed by your Correspondent ("A Dyer of Armitage,") in No. 121 of your valuable Magazine, as an improvement upon the old method of Grinding Indigo, is liable, I think, to one objection. The axles of his conical rollers, working constantly in the fluid indigo, will soon be worn away, and the rollers then become useless, or they will require such frequent repairs as to add very materially not only to the expense but to the inconvenience of his suggested improvement. If this defect can be remedied, I think there may be some advantage in the plan he has proposed, inasmuch as the process of grinding will be facilitated, and probably the indigo more minutely divided or pulverized.

The plan adopted by your Correspondent "Blue Vat," and which he complains of as being incomplete, is the one that has been in almost general use by the blue-dyers in the West of England from time immemorial, and if properly managed, and sufficient time allowed for the grinding, according to the hardness or mellowness of the indigo, answers the purpose effectually.

I have made use of this method for upwards of thirty years, and have no reason to be dissatisfied with it. I allow my indigo to grind generally a fortnight, and sometimes longer; the pots work day and night, and, when any indigo is wanted, it is dipped off as we turn it, and is reduced to a fine soft paste about the consistence of castor-oil.

The creaming appearance that "Blue Vat" has observed upon the surface of his vats, is no indication that his indigo has not been sufficiently ground, but a proof that the fermentation is in a proper state, and is produced merely by the absorption of oxygen, which every blue-dyer knows (or ought to know) is essential to the perfection of indigo blue.

I remain, Sir,
Your obedient servant,
A Somersetshire Dyer.
Frome, February 13th, 1826.

WIND-LATHE.

Sir,—I fear that I shall not be able to answer satisfactorily the questions proposed by N. W. G., in a late Number, but I feel it necessary to say a few words on the subject, in explanation of my promise to give further information.

The whole of my knowledge—if it can be said to be knowledge—of the good or bad properties of the Horizontal Windmill, which I attempted to describe in No. 113, depends upon theory; I have never seen any thing of the kind put in practice,

It appeared to me to be an improvement on the plan previously described by Clio, in No. 98; and all that I could have then said, or can now say, more than is stated in my first communication, would be to point out wherein this improvement consisted. If the principle be good, of which I have no doubt myself, and which the model made by N. W. G. seems to prove, the minor matters, as to length of arms, height, &c. may be left to the judgment of the builder, to be regulated according to the quantity of work required to be done, and the situation in which the mill or lathe may be erected. On the top of a hill, or on an open plain, the elevation of the arms need not be great; but, in partially confined situations, the building must, of course, be high. In this respect it would be like the common windmill.

I am fond of experiment, and had I the means, which I have not, I would make a good-sized model, in order to convince myself of the *effect* produced by the horizontal arms. Were I to have the direction of putting up a mill on this principle, to do a given quantity of work, I should calculate as near as I could as to the surface necessary to each arm, by a comparison with mills on the old principle, but at the same time making the arms in such a manner that I could easily either lengthen or shorten them. The necessary extent of surface may be thus obtained without any great trouble or expense. I know of no other way: the wind seems too variable in its effective power to allow of any thing like accurate calculation to be built upon it. It is necessary that the arm should have sufficient surface to do the required work with the aid of a *moderate* wind; and it is necessary also that this surface be easily contractible when the wind is more fresh. This I should think may be done by some easy means of fastening (either open or closed will do) any number that may be required of the wind-boards.

The breadth of the wind-boards is but of little importance, and may be made to suit the taste or the convenience of any one who may adopt the plan. The height of the mill should be regulated by the situation, the favourable or unfavourable circumstances attending which may be easily ascertained.

The above are not answers to the questions of N. W. G.; they are merely hints on which he or others may perhaps improve.

I should be happy in being favoured with N. W. G.'s address. I trust that I shall not offend. If he will leave his address with the Editor of the Mechanics' Magazine, directed to R. H., he will oblige me. I shall be in London during the coming Spring, and should N. W. G. live in or near, and have no objection, I should feel happy in having a sight of his "model."

I am, Sir,
Your obedient servant,
R— H—.

THE LATHE.

Sir,—A few weeks ago, a friend of mine lent me the first and second volumes of the Mechanics' Magazine. In perusing them, I found an improvement had been made on the common Lathe, by Mr. Charles Williamson; and having myself devised what I have found by long experience to be a beneficial alteration in the mode of working it, I think it may not be amiss to send you the particulars thereof.

About twelve or fourteen years ago, I observed, in working a foot-lathe, a manœuvre of the lathe-string, which gave me an idea that it might be worked somewhat in a different way. Having accordingly made a little alteration on the mandril pulley, I took the line and lapped it round the pulley one complete round more than it worked before. By so doing, I found that great part of the friction was taken off, and that the lathe worked extremely well. Since then I have made a further improvement, so that the lathe-string may be worked once or twice, or thrice (or more, if

necessary, round the wheel and the pulley. But one extra lap round the wheel, and two round the pulley, will, in most cases, I think, be found sufficient. By this new method of working the line or lathe-string round the wheel, pulley, or drum-barrel, the friction is nearly all taken off; the line, too, seems free from fretting.

I have no doubt that this device might be advantageously applied to various other pieces of machinery that work in a similar manner to the lathe.

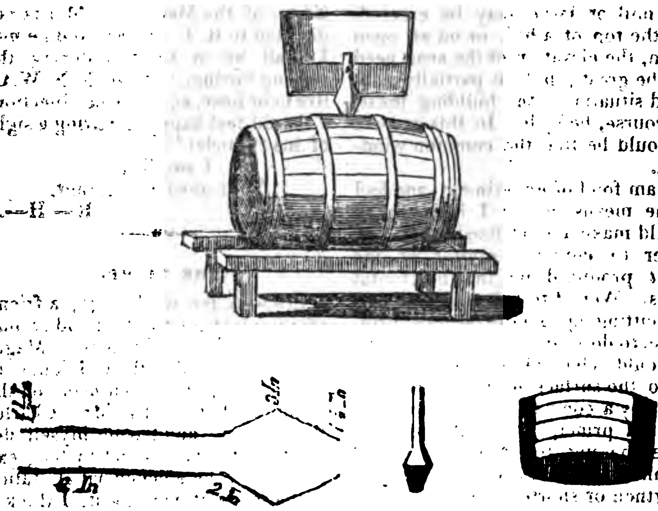
I am, Sir, yours, &c.

S. B. Z.

January 28th, 1826.

P.S. If any person or persons should wish for further information, they may have it. Letters addressed, post paid, to S. B. Z., at Mr. Bas-ford's, printer, Bilston.

MR. DICKINSON'S BEER-CLEANSING APPARATUS.



Sir,—I have much pleasure in taking up my pen for the purpose of satisfying your Correspondent ("A Tipton Brewer," page 320, vol. iv.), but being a considerable distance from home, and not being able here to get any of the back Numbers of your publication, I scarcely carry in my recollection the purport of the letter to which your Correspondent alludes, and at this time must satisfy myself, and hope at the same time your readers, by merely describing the improvement in the conveniency of my Cleansing Apparatus.

R. W. Dickinson.

Ilfracombe, North Devon,
Sept. 2, 1825.

Description.

The last of the prefixed figures is the cleansing cap, with apperture in the bottom. The second and third represent a tube turned, as a cone inverted, the upper part being perfectly straight; the lower part being put into the bung-hole of the cask, the cleansing cap is then to be put over it. After having fitted the tube to the cap, cut an aperture in the tube one inch from the bottom, for the purpose of fitting the cask; the cap should be *nearly* equal to half the contents of the barrel. The first figure represents the cask with apparatus complete.

[This should have appeared sooner but was unfortunately mislaid.—Edit.]

ON SHIP-BUILDING.

(To the Editor of the Mechanics' Magazine.)

SIR,—Observing in your Number for August, Philo-Naut's remarks on Naval Architecture, and having a little spare time on my hands, I take the liberty of sending you a few observations on Ship-building generally, to which I shall annex a plain and simple method for a young beginner to construct merchant vessels, on principles that will be sure to meet success. Should they on inspection be thought worthy a place in your columns, I shall be proud to extend them at some future period.

There is no branch of art in this country which has made such rapid strides in theory, as that of ship-building, yet there is no branch so very deficient of fixed principles; there is scarcely one given rule to direct the judgment in erecting a structure, with any degree of certainty. It was expected that the nation would be greatly benefited by the establishment of a Naval Academy, which has now been formed more than fifteen years; but what has been done to promote either a national or individual good? Nothing—less than nothing. They have perplexed, they have bewildered the mind; instead of light there is darkness; all is speculation, which has terminated in fallacy, and we are again thrown back on our own resources. Thirty years since, there was not one in twenty of all the numerous class of ship-builders that understood the first principles of laying off a ship from a given drawing. As to constructing a body on paper, they were, with a few exceptions, quite incapable of it. Almost all vessels were built by what is generally termed the eye. A person about to have a vessel built, gave the length, breadth, and depth; from this the keel was laid, and the stem and post erected; a midship section was then formed by eye, from which, with a little alteration, five or six frames were got in place. Ribbands were next extended from stem to stern, from which the vessel was filled in; and such was the correctness derived from habits and application, that a vessel thus built would vie for every qualification with the best vessels constructed by the most scientific men. To such perfection was this eye system carried, that, for vessels of passage, the ship-builders who followed it had no competitors in all the science of the country. I knew a ship-builder in the West of England, who built more vessels of passage than any man in his day, from the smallest class to those of 180 tons, including luggers and cutters, with only one midship mould, so formed by the eye, that they would challenge the world for fast-sailing, stability, and beauty. So exact were their proportions, that I have more than once, the morning after they were launched, seen them ground on their keel, without touching a leg on either side. The day of eye-knowledge, however, is almost gone by, though I can hardly say it is superseded by that of books and theory. Not only the masters, but, I should think, one-eighth of the working class of shipwrights, understand the theory in part; that is, they are copyists, but there are very few who have entered on the science of construction. By construction, I mean the planning on paper a vessel of such dimensions as to be best calculated, in every respect, for the purpose required. In furtherance of this desirable object, I send you a plain and simple method, whereby those necessary qualifications, and the real burthen, are to be known. (It must be understood, that my information is to those who already know the theory, as before stated.)

To construct a vessel which is to carry 1-4th, or 2-7ths, more than her register tonnage, get in your keel; then erect your two perpendiculars, on a quarter scale, at the two extremes; next settle the disposition of your timbers, and fix on the station of your dead flat; if a square-rigged vessel, the best proportion is between 3-7ths and 4-9ths from your foremost perpendicular

Exercise your judgment in forming your midship section, which having got in, in pencil, proceed to get in your lower water-line on the sheer plan, allowing a quarter of an inch (more or less, as may be required) to the foot, set by the stern; set up from this your other water-lines parallel, till you get to the height you have fixed upon for your load-mark; transfer those lines to the body plan; when done, set them off on your half-breadth plan; this gives you the half-breadth of each separate water-line at your midship section; you should then, with a batten or moulds, get in each respective water-line, giving them a nominal ending, till you have concluded them well, from which, when corrected, you form your stem. Look over them closely, to see if they are fair, and that their proportions are regular, taking care that your lower lines forward are not too full, so as to create a round in the heel of your bow timbers; let your after-lines below be as fine as possible, for on this depends the free ingress to the rudder, whereby she will steer easy, and be quick to her helm; keeping in view, that it is not extended too near the midship section, which will give her a short bottom, by which she will lose her capacity; for you must observe, after you have passed the round of your bulge, that you commence your straight-in-midships, increasing on each line till you get to your load-mark, which should be nearly straight two-thirds of her length. This line must also break into your main-breadth line, for on this line is required her greatest capacity, being the point of pressure. Having got in your water-lines on the half-breadth plan, to your satisfaction, proceed to get them on the body plan, observing that your after-timbers embrace the S form as much as possible. Straight timbers aft should be avoided; vessels of this description labour much in a sea, as well as steer hard, and too often lean on the quarter. By throwing in a few diagonal lines, you will fair your body and correct your water-lines. When you are satisfied on these points, get some pieces of fir of the thickness of the space between your water-lines, they being parallel, except the lower line, which tapers; form your fir to each separate water-line on the half-breadth plan, keeping one edge well at the middle; this being done, glue or fasten each respective piece to its corresponding line, clean them off, and you have an exact model of the bottom of your vessel. I would here remark, that in getting in your water-lines above your light water-mark, you should fill out your bow and quarter as much as fairness will admit; by this you get your capacity; few vessels are too full aloft, although they may be from the light mark below. Should you be satisfied with your proportions, set off on your block 11-48ths of the keel from forward; at the ending of your lower water-line square it up and over; cut it off at this section; then set off 13-48ths from the same line from aft; square it in the same manner, and cut it off. Your block is now in three pieces; the middle piece will be in length equal to the other two. Measure your middle piece very correctly for the displacement of water; the tons it will produce, multiplied by two, will be her real burthen; the fore and after pieces, adding thereto the thickness of the bottom plank (the block being to the timbers), if correctly proportioned, will displace water equal to the weight of the vessel with all her furniture. You now proceed to get in your wing transom, whose length should be at least two-thirds of the extreme breadth; let your height be as near the load-mark as your buttock lines will admit. It is a great evil when the wing transom is too high; it gives the vessel a faint hollow quarter, which is bad in scudding. In getting in your upper timbers, you will meet with little difficulty, being nearly all of one form, except forward, where they should pare off as much as fairness will admit, to give room forward to work the vessel. The ornamental parts, such as bow, stern, sheer, &c. are all fancy. By following those rules

in a few instances, the learner will soon have his judgment matured, and be able to construct vessels of all descriptions, with the best qualifications for cargo, sailing, and ease in a sea. The proportion of length to breadth in floating bodies, so as to form the least resistance, has never been as yet defined with respect to the construction of vessels of passage, because the propelling power cannot be brought to act on the same point. A long, narrow, flat vessel will sail faster before and off the wind, than a wide, sharp vessel; whereas the latter, on a wind, not only in many instances fore-reaches, but invariably passes to windward. Prior to Mr. Pitt's Act, so called, which confined vessels to one-third of their length for their breadth, vessels, particularly luggers, were generally as one is to four. I knew a lugger, at this time, seventy feet long, with only ten feet beam; this vessel, in light winds, would sail faster than any vessel in Europe. She continued many years as a smuggler, sporting with every vessel that would attempt to give her chace, till she was lost in a gale of wind. A Dutch merchant, some years since, built a vessel of 200 tons on the principles of the ark; that is, one-sixth of her length for the breadth: this appears to be carrying things to an extreme, yet she answered fully his expectations, and proved a serviceable vessel.

(To be concluded in our next.)

NEW PATENTS.

John Frederick Smith, of Dunston Hall, Chesterfield, Esq.; for an improvement in the process of drawing, roving, spinning, and doubling wool, cotton, and other fibrous substances. Dated Jan. 19, 1826.—Six months to enrol specification.

William Whitfield, of Birmingham; for improvements in making or manufacturing of handles for saucepans, kettles, and other culinary vessels, and also tea-kettle handle straps and other articles. Dated Jan. 19, 1826.—Six months.

Benjamin Cook, of Birmingham, brass-founder; for improvements in making or constructing hinges of various descriptions. Dated Jan. 19, 1826. Six months.

Abraham Robert Leorent, of Gottenburgh, merchant, at present residing in King-street, Cheapside, London; for a method of applying steam, without pressure, to pans, boilers, coppers, stills, pipes, and machinery, in order to produce, transmit, and regulate various temperatures of heat in the several processes of boiling, distilling, evaporating, inspissating, drying, and warming, and also to produce power. Dated Jan. 19, 1826.—Six months.

Sir Robert Seppings, Knight, of Somerset-House, London; for an improved construction of such masts and bowsprits as are generally known by the name of made masts and made bowsprits. Dated Jan. 19, 1826.—Two months.

Robert Stephenson, of Bridge Town, Warwickshire, engineer; for axletrees to remedy the extra friction on curves to waggons, carts, cars, and carriages used or to be used on railways, tramways, and other public roads. Dated Jan. 23, 1826. —Six months.

NOTICES TO CORRESPONDENTS.

The alteration suggested by M. S. cannot be made just now, but will probably in a short time.

G. S. in our next.

The article on "Safety Gigs" is in type, but unavoidably postponed for want of room.

Communications are received from—W. W.—W. R. G.—S. A. L. A.—J. W. A. —Mr. Toukin—A Mechanic and Subscriber—Mr. Sumpter—G. M. H.—Mr Hall—W. D.—Blue Beard—A Skinner—A Manufacturer.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

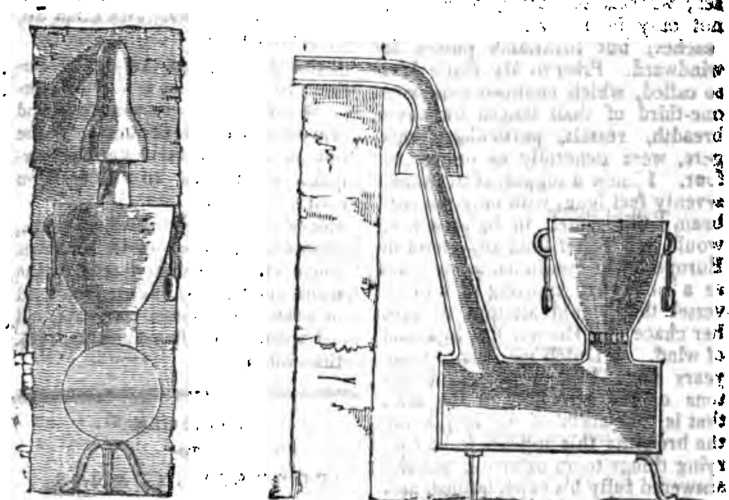
Printed by MILLS, JOWETT, and MILLS (late BENSLEY), Bolt-court, Fleet-street.

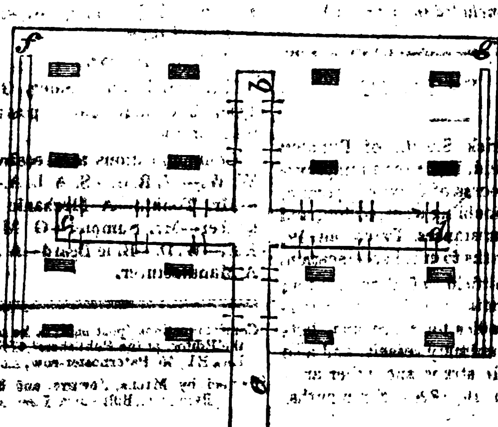
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 132.] SATURDAY, MARCH 4, 1826. [Price 3d.

HEATING HOUSES AND APARTMENTS.





HEATING HOUSES AND APARTMENTS.

"The Theory and Practice of Warming and Ventilating Public Buildings, Dwelling-Houses, and Conservatories; including a General View of the Changes produced in Atmospheric Air by Respiration, Combustion, and Putrefaction, with the Means of obviating its deleterious Agency; and a Description of all the known Varieties of Stoves, Grates, and Furnaces; with an Examination of their comparative Advantages for economizing Fuel, and preventing Smoke.—By an Engineer; 340 pp. 8vo. With numerous Copper-plate and Wood Engravings." T. and G. UNDERWOOD.

We have been much pleased by the perusal of this volume. It is full of useful and instructive information, conveyed in a very popular style, and is in an especial manner deserving the attention of all that numerous class of persons concerned in the construction of houses and public buildings. We cannot justly give it the praise of *completeness*, for there are many things omitted which one might have naturally expected to find in it (in particular, the various plans for consuming smoke, which were some time ago the subject of Parliamentary inquiry); but all that it does contain is extremely to the purpose.

The author commences by giving a brief view of the nature of fuel, and of the chemical principles on which combustion and animal respiration depend; with a variety of useful suggestions for preventing the deleterious effects of a vitiated atmosphere on animal life. The influence which he assigns to the azotic portion of the atmosphere, is greater than chemical writers generally allow; but his positions, though somewhat novel, are well supported, both by fact and argument. The attention of the reader is next directed to the noxious agency of stagnant water, and of putrescent animal and vegetable matter in the vicinity of populous districts, and the best mode of purification and ventilation. This is followed by a description of all the known varieties of grates or stoves, with observations on their comparative advantages in economizing heat, and preventing the disengagement of smoke; an account of the various modes of building furnaces, setting boilers, and constructing apparatus for warming buildings of all kinds, by means of steam heat; observations on the construction and management of garden stoves and conservatories, &c.

In treating of "close, chamber, and vase stoves," the author speaks rather unceremoniously of the celebrated Dr. Franklin's contributions to this branch of domestic economy.

"Although the general talent," he observes, "or, rather, the universal talent, of Franklin must ever be acknowledged, yet it cannot be denied that this great man was sometimes in the habit of availing himself of the discoveries or suggestions of others, and often effecting a slight modification in their arrangement, announcing such inventions as his own *ab origine*. Thus, in the case of stoves or grates for more effectually economising fuel, many of the inventions, described in his Essays, were adaptations of the inventions of French or German philosophers."

Of this specious sort of appropriation we are then favoured with the following proof:—

"In the middle and latter end of the 17th century, a M. Dalesme, a French engineer, invented a domestic stove or furnace, with the view of giving out nearly all the artificial heat to the apartment, whilst it was calculated to consume the smoke at the same time. The apparatus, which is the invention of Dalesme, improved by Dr. Leutmann, a German, is represented by the wood-cut (the first of those prefixed to this notice). We should, at the present day, consider this apparatus rather rude, but as it obviously forms the basis on which several later inventions have been founded, it is worthy of mention here. The vase, or fire-chamber, may be taken off, and filled with lighted charcoal or wood, and the drum, or lower chamber, and pipe, being then heated, by burning a little light wood or shavings, the vase is to be replaced, when the air, being only admitted at the top of the vase, will drive a current of

heated air and smoke up the pipe and into the flue of a chimney. It must, however, be evident that some part of the smoke and vapour will ascend from the top of the vase into the room, and that it could only be used with any comfort with charcoal or wood very well dried.

"Dr. Franklin, in adopting this principle of constructing stoves, actually retained the vase-like appearance which Leutmann had given to the fire-place; and, indeed, the only essential alteration he made in the construction was that of flattening Dr. Leutmann's drum, or lower chamber, into the shape of a hollow hearth, divided into flues, and not admitting any air to pass into the chimney beyond the fire. This last alteration renders his stove more truly a close stove than Dr. Leutmann's."

"As a farther sample of the merits of the work, we shall extract, on account of its novelty, the author's account of the "Chinese Mode of Heating Apartments."

"Notwithstanding the national jealousy of the Government of the immense empire of China almost prohibits every species of intercourse with other nations; and the patriarchal system of government which has been adopted throughout the whole mass of society for a long series of ages, renders it almost impossible that these singular people should have derived any material improvements or discoveries in the arts from any other nations; yet the high state of perfection to which very many of the useful arts have attained, prevents us assuredly from considering them in the light of barbarians, or, indeed, as any thing less than a most ingenious and inventive race of people, however much they may vary from that conventional standard, which we, in our national greatness, term civilization.

"In domestic economy, and in agriculture, especially, the Chinese are economists in the strictest sense of the word; and in some cases they extend this economy to limits which would not exactly square with our notions of delicacy. Nothing in China is considered useless, or is thrown away, from its minor value. And whether this rigid economy may be owing to necessity, on account of the extremely dense population of the country; or whether it be the result of deliberate study and experimental research, the fact appears unquestionable, that in several departments of the operative arts and manufactures the Chinese afford us models well worthy of our imitation or adoption.

"In the management of fuel for heating buildings and other domestic uses, they are admirable economists, according to the best accounts we have received of their internal arrangements. English travellers have indeed had very little opportunity of becoming acquainted with the domestic economy of the Chinese, owing to that commercial jealousy, which makes them exclude our countrymen from visiting the interior of the country. The French missionaries of the last century are, indeed, the only authorities from whom we gain any information concerning the internal and domestic arrangements of these singular people. According to the account of Father Gramont (Phil. Trans. 1771), the climate of Pekin, where he was long resident, though 10 degrees farther south than the latitude of London, is considerably more severe in the winter season than the climate of England; the thermometer ranging from 9° to 13° below zero of Reaumur's scale; or from 20° to 30° below the freezing point of Fahrenheit.

"In order to counteract this low temperature, the Chinese adopt the most scientific principles that could be resorted to—that of building their houses with double walls, and having hollow flues extended beneath the floors; by which all the heat which is generated, is made available for warming the apartments.

"In the better class of houses, the fire-place is constructed either against the exterior wall of the apartment to be heated, or else in an inferior room adjoining; by which means the inconvenience of servants entering the

rooms to superintend the fire, as well as the nuisance arising from dust or smoke, is completely avoided. From the fire-chamber proceeds a main flue, which is connected with the horizontal flue, *a b*. (See second cut in our first page.) From *a b*, another flue, *c d*, proceeds at right angles to about three-fourths of the extent of the room. These flues are perforated with holes at proper distances, in order to give out the heated air and smoke equally over the whole area of the flooring. Two horizontal flues are built in, or attached to the side walls, as at *f g*, in order to carry off the smoke into the external air, or into the flue of an upright chimney. The flooring of the apartment consists of flat tiles, or of flag-stones nicely embedded in cement, so as to prevent the escape of the smoke or heated air from the flues beneath, into the room.

(*To be continued.*)

BLACK CLOTH.

Sir,—I should feel particularly obliged, if any of your numerous Correspondents will inform me, through the medium of the Mechanics' Magazine, where good Black Cloth is to be procured, the colour of which will wear well, and bear exposure to the sun and air without fading, such as was manufactured some years ago. I am inclined to think that the manufacturers of the present day go the cheapest way to work, and in dyeing their black cloth, omit that very essential article, indigo, in the composition of their colours, and substitute in its place logwood and sulphate of copper, which my Encyclopædia informs me, being much cheaper articles, are too often made use of as a component part of the black dye, to the exclusion of indigo, whereby the colour is rendered fugitive, very liable to stain, and fades in a short time when exposed to the effects of the sun and air. I therefore conclude, that the want of permanence of the black cloth now manufactured, proceeds from its being dyed by the spurious process above alluded to. As an instance, my last black coat, which cost me four guineas, has only been worn a few weeks, is already beginning to fade and change colour, turning to a dingy kind of slate colour, and is really become so shabby that I am ashamed to wear it, although the cloth is very little the worse for wear. This to me is a great grievance, as black is a colour I am very partial to, and being a colour that is now so very generally wore, I think it highly necessary that the manufacturers should endeavour to improve their present very defective process.

In the present age, when the arts and sciences are making such rapid strides, and when, particularly, chemical science has been so much improved, surely it is not too much to hope, that some of your chemical Correspondents will avail themselves of the hints I have afforded them, and suggest to the manufacturers an improved process for dyeing black, combining beauty of colour with permanence and durability. Such an improvement would be of infinite service to the public at large, and, amongst them, to

Your obedient humble servant,

Chemicus.

Bath, February 28th, 1826.

BURNING SPRING.

A spring which emits inflammable gas has been discovered in the town of Palmyra, Wayne county. Probably arrangements will be made to light that beautiful village from this natural fountain. There is a village in the county of Chautauque already lighted with natural gas: and who knows but that much of our western country will yet be lighted from the sun by day and the earth by night!—*American Paper.*

ALGEBRA.

SIR,—In a note to Bonnycastle's Algebra, eleventh edition, page 127, he says (under Cubic Equations), "that the solution of the *irreducible cases*, except by means of a table of sines, or by infinite series, has hitherto baffled the united efforts of the most celebrated mathematicians in Europe." Through your publication, I therefore beg to offer a solution, which I think will be applicable in all cases where there are real roots, and which any person acquainted with the common methods of extracting the cube and square roots will easily understand by inspecting the following examples; the two first are the 7th and 10th in Bonnycastle's Algebra, and the third is merely added to show another variation in the form of the equation.

I remain, Sir, your humble servant,

Mamps, near Oldham. WILLIAM HOYLE.

EXAMPLE I.

Given $x^3-48x^2=-200$, to find the value of x.

By transposition we have $48x^2-x^3=200$.

48	−1	92) 200 (2.0871
		184
2 root	4 square root	
96	−4	1833536) 16000000
4		14668288
92 first divisor.		186993071) 1331712000
		1308951497
		18728936689) 22760503000
		18728936689
		4031566311

The divisor in extracting the square root } 408	120000
48	4800
	64
1958400	124864 cubic divisor
124864	−1
second divisor 1833536	−124864
4167	12979200
48	43680
	49
200016000	13022929
13022929	−1
third divisor 186993071	−13022929
41741	1306670700
48	62610
	1
20035680000	1306743311
1306743311	
fourth divisor 18728936689	

EXAMPLE II.

Given $x^3-22\,x=24$, to find the value of x.

```
           1      -22
         ________________
          25
          22
          __
1st...... 3
          __

         7500
          150
            1
         ____
         7651
         2200
         ____
2nd ......5451
         ____

         780300
           9180
             36
         ______
         789516
         220000
         ______
3rd ......569516
         ______

        79876800
           30960
               4
        ________
        79907764
        22000000
        ________
4th......57907764
        ________

        7993873200
            309720
                 4
        __________
        7994182924
        2200000000
        __________
5th......5794182924
        __________
```

```
                3)24(5.1622
                  15
                  __
           5451) 9000
                 5451
                 ____
        569516)3549000
               3417096
               _______
     57907764) 131904000
               115815528
               _________
  5794182924) 16088472000
              11588365848
              ___________
               4500106152
              ___________
```

N.B.—The ciphers prefixed to 22 will be accounted for by considering that the cube of a decimal, one figure, has one cipher more than the square, and two more than the root, as

```
  .2
  .2
  __
 .04
  .2
  __
.008
```

EXAMPLE III.

Given $x^3-30x^2+252x=400$.

	1	—30	252	196)400(2056
				392
	4	—2	252	
			—60	1428025)8000000
120000			4	7140125
3000				
25			196	141464436) 859875000
				848786616
123025				11088384

	405	2520000
		—1215000
		123025
		1428025

12607500	4106	252000000
36900		—123180000
36		12644436
12644436		141464436

ANSWER TO BIJA GANNITA'S QUESTION.

[To the Editor of the Mechanics' Magazine.]

SIR,—In reply to Bija Gannita's question, in No. 129, page 259, of your valuable and interesting Magazine, "to divide the number 44 into two such parts that the greater, increased by 5, shall be to the less increased by 7, as 4 to 3," to be answered without multiplication, I beg to give the following answer:—

Let x and y be the two numbers, then, per question, $x+y=44$,

$$\therefore x = 44 - y;$$

and, per question, $44-y+5 : y+7 :: 4 : 3$;

then, by composition, $56 : y+7 :: 7 : 3$;

and, by division, $8 : y+7 :: 1 : 3$,

$$\therefore y = 17,$$

and $x = 44 - y = 27$. Q.E.D.

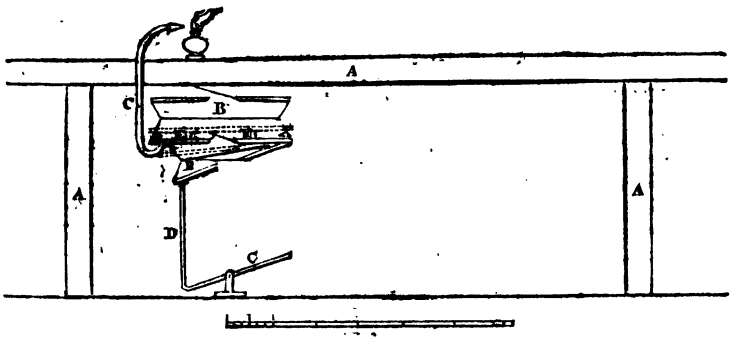
I remain, Sir,

Your most obedient servant,

H. HUBERT, Jun.

Rock Life Assurance Office,
February 14th, 1826.

BLOW-PIPE.



SIR,—Having seen several plans of Blow-pipes in your valuable work, I herewith send you another. Whether original or not, I cannot tell, but I conceive it will answer the purpose intended.

I remain, Sir,
Yours respectfully,
THOS. GREENWOOD.
Gildersome, near Leeds.

Description.

AAA is the work-board, two feet six inches high.

BB, the bellows. The dotted lines represent them shut, and the full ones open. The top and bottom of the upper part is made of deal, ¾ inch thick, 18 inches long, and 12 broad. The sides or flaps are made of ½ inch deal, 3 inches broad, cut to a square mitre at the corners, so as to lay flat on the board, leaving a space of not less than 1-8th of an inch between each joint, so that, when the leather is glued on, the corners may not bind against each other. The bottom part of the bellows, or (as it is called by workmen) the feeder, is 15 inches long, and the same breadth as the other part. The flaps or boards at the end are 2½ inches broad, and those at the sides are the same breadth at the broad end, and cut to meet in a point at the opposite end of the feeder (which must be hinged with leather to the upper part), leaving a space between the joints to prevent their chafing. The valves or clacks, like those of a common bellows, must be cut before the bellows are put together; they should be about three inches square, made of thin wood, hinged and covered with leather, so as to be wind-tight. They must all open upwards, each to be placed in the centre of its respective board or partition. The top valve is to prevent the bellows bursting, and should be rather stronger than the others, and may be weighted at pleasure, according to the strength of the blast required, as also must be the top of the bellows. All the joints must next be hinged with wash leather, strongly glued on, so as to be wind tight.

C, the treadle. It is 14 inches long, and works on a pin six inches from the joint of the spear, as seen in the drawing.

D, the spear, from the treadle to the under side of the feeder, about 14 inches long.

C (2), the pipe, to convey the wind from the bellows to the lamp (this may be a piece of glass piping), which is on the left end of the bellows, at a convenient distance from the edge of the bench, and made to terminate at the top of the work-board. The end must be rather conical, for the next piece to fit in, which, of course, must be bent, to bring the point horizontally; this point must also terminate in a small conical form. The final point of the pipe (of which there ought to be three or four sizes) is of the most importance, and the best material I know of is tobacco-pipe clay.

You may get a quantity of them made for a trifling sum of different sizes, to fit the end of the bent tube. The best mode is, to make the hole wide at the thick end, and terminate gradually to the width required. A little tow wrapt round the end of the bent tube, and greased with tallow before the pipe is put on, will make it wind-tight. A common tobacco-pipe may sometimes be used, when you have not another at hand.

FF are two small bits of wood for the bellows to fall upon, to prevent the leather joints breaking.

This machine may be used for blowing a small fire, and other useful purposes.

N. B. It must be observed in fixing this machine, that the middle board of the bellows must be fast, leaving the other at liberty.

ENGLISH GRAMMAR.

(*Continued from page* 295.)

OF THE ADJECTIVE.

Sir,—I am convinced that we shall get over this part of our road without a stumble.

Adjectives, of which there are about 9200 in our language, are words generally joined to, and always belonging to nouns, of which they express the quality; as, a *foolish* man, an *accomplished* woman, a *fine* tree, a *sincere* friendship. Here the words *foolish, wise, accomplished*, and *sincere*, are adjectives.

The *adjective* derives its name from *adjacio, to put to;* and is thus called, because it is put or added to nouns.

This is a very necessary part of speech. Suppose, for example, that I accidentally meet half a dozen ladies, with whom I have not the slightest acquaintance, and am desirous of speaking to a friend of some one amongst them, whose affability or beauty particularly attracts my attention. Without the adjective I might find some difficulty in explaining to him which lady I mean; but when I say, the *tall* lady, the lady in the *pale blue* gown, the *dark* lady, she with the *flaxen* hair, or the *short, plump, smirking, good-natured, little* piece of vanity, he gets at my meaning; and perhaps, in the long run, I get a wife.

Examples.

All other goods by Fortune's hand are
given;
A wife is the *peculiar* gift of Heaven:
Vain Fortune's favours, never at a stay,
Like *empty* shadows, pass and glide away.
One *solid* comfort, one *eternal* wife
Abundantly supplies us all our life.
This blessing lasts, if those who try say
true,
As long as heart can wish—and longer
too.

I have been hunting in all the books that are handy, for an extract in favour of the ladies—O *vile* poets! I cannot find *one!* However, that the *fair* part of the creation may not be without a champion, as I have been a bit of a rhymster from my youth, I'll even try what I can do myself:

How blest the man, how *enviable* his
fate,
On whom the Gods bestow a *virtuous*
mate!

Or, if you like it *better*, as the *last* expression is somewhat *antiquated*—

How blest the man, how *enviable* his life,
On whom the Gods bestow a *virtuous*
wife:
For him, unmoved, she every ill sustains,
Smiles when he smiles, and weeps when
he complains;
Her lisping children round their father
press,
And smiles bespeak the parents' happi-
ness.

The participle, a peculiar form of the verb, is sometimes, by beginners, mistaken for the adjective. As I shall speak of the verb when I next address you, and I will then show how these two are to be distinguished.

I am, Sir,

Your obedient servant,

Wm. Smith.

THE DIORAMA.

[*To the Editor of the Mechanics' Magazine.*]

Sir,—Incidental hindrances having repeatedly frustrated my intention of visiting the Diorama, or exhibition of paintings, in the Regency Park, it was not till yesterday that I had an opportunity of gratifying my wishes. Were I to give full scope to my feelings, and expatiate upon the pleasure I experienced, I fear it would be deemed superfluous; I shall therefore merely offer to your notice, and to the notice of your subscribers, a few observations on the two paintings that were yesterday, for the first time, publicly exhibited. The one is a view of the City of Rouen, the other an interior view of the Chapel of Rosslyn.

The view of the City of Rouen is from the pencil of M. Bouton. The ærial perspective is ably managed, and the various objects recede from the canvass in all the witchery of real life. The vista, through the long avenue of trees, is particularly pleasing; and one, in prospective fancy, can easily picture to himself the pleasure he hopes one day to experience, by descending from the Mount St. Catherine, and pursuing his way along this avenue to Paris. Independently of the beauties of the surrounding scenery, and the effect of the rays of rainbow-light which were occasionally introduced at the further extremity of the picture, there were other objects that attracted my attention, and produced in my mind a variety of pleasing associations. These were the view of the various cotton-spinning and other manufactories (particularly that belonging to M. Levavaseur), which appear indiscriminately to be scattered around.

Abstracting our attention, however, for the present from this painting, in which there are so many objects that ought successively to claim attention, we will next take a retrospect of the view of Rosslyn Chapel, which has been painted with much fidelity by M. Duguerre.

The Chapel of Rosslyn is situated on a rising ground, called College Hill, in the parish of Lasswade, about seven miles S. by W. of Edinburgh; and many of your subscribers both in and from the Northern metropolis will, doubtless, recollect the many festive days they have spent amidst its agreeable scenery. The Chapel was never finished, but is one of the most curious models of the architecture of the 15th century, being a combination of the Egyptian, Grecian, Roman, and Saracenic styles. It was founded in 1446 by William St. Clair, and built, in the middle of a beautiful garden, with a sort of red granite stone, hewn from the neighbouring rocks.

Among the most remarkable objects examined with attention by the visitors to this Chapel, is the Apprentice's Pillar, which is a wreathed column, the last on the right-hand side of the picture. A tradition has prevailed in the family of Rosslyn, that a model of this beautiful pillar having been sent from a foreign country, the master mason, on viewing it, refused to imitate it till he had seen the original. In his absence his apprentice executed the pillar as it now stands, and the master mason, on his return, seeing it so exquisitely finished, slew the apprentice in a fit of envy. It is singular that a similar story is told of some of the best sculptures in Melrose Abbey, and I believe also of a much later production of art, the statue of King Charles the Second, in the Parliament-square at Edinburgh. Notwithstanding, therefore, that two heads are exhibited in the Chapel, the one as frowning, and the other with a scar or indentation on his forehead, and said to be representations of the master and his apprentice, I believe I am justified in believing the tale to be a mere idle tradition, more particularly as there was formerly a superstitious story current among the common people of the neighbourhood, that, previous to the death of any member of the St. Clair family, this Chapel was to be seen in flames without sustaining any injury.

Returning from this, perhaps, ne-

cessary digression, I shall venture a few cursory observations on the merits of the painting, which, as I have already stated, is executed with much fidelity. The pillars, the arches, the mullions, and the tracery, are represented in their present dilapidated state; and the colour of mouldiness, arising from the moisture of the atmosphere of Scotland, is well expressed. There are various articles of still-life which also deserve our approbation; but that which seemed to give the greatest delight to those around me was the artful and pleasing manner by which rays of light, resembling the sun's beams, were occasionally introduced and withdrawn.

Notwithstanding, however, what I have said of these paintings, there are some few defects that I could wish to point out, but shall reserve my observations for a future paper, in which I purpose describing to your readers the manner in which the effects of light and shade, mist and sunshine, are so beautifully managed.

I remain, Sir,

Your obedient servant,

A Civil Engineer.

Tuesday, February 21st, 1826.

ADJUSTING SCALES AND WEIGHTS.

Sir,—On reading Mr. Gutteridge's account, in your 130th Number, of the effect of a slight heat upon a scale-beam, I am induced to trouble you with an observation of my own. Being lately engaged in adjusting some weights in a pair of scales that I believed to be as accurate as possible, I was much surprised at their oscillating considerably, and, thinking that something was the matter with the scales, I set about adjusting them, but for some time without any success; at length, recollecting that the shop-doors were open, I shut them, and the scales immediately resumed a proper equipoise. I was not myself sensible of any particular current of air stirring at the time, but I am convinced that it was nothing else that operated to destroy the just equilibrium of the scales. I do not state this as a new discovery, but only to show the great nicety required in adjusting scales and weights, and the caution that officers appointed by the Court Leets should use when they examine scales and weights (and who, possibly, may not be aware of the effect such slight causes have upon a well adjusted beam), and how requisite it is that they be fully satisfied that no external cause operates to destroy the equilibrium before they seize the scales or amerce the owner in a fine. T. J.

BORING FOR WATER.

It was my intention, but for the pressure of other business, to have sent you an answer to the inquiry of a Subscriber, in No. 126 of your Magazine, respecting the purifying of water, similar to the answer given by T. W. in your 130th Number. Boring for water has been much practised about Hammersmith lately, and, besides the very superior quality of the water, I do not know of one instance wherein less than a regular supply of 80 gallons per hour has been obtained, and in some instances 2 or 300 gallons per hour. The depth has generally been from 300 to 380 feet before it was found, after which it runs over at different heights above the surface, according to the strength of the spring. There is a clever man here who has had a deal of practice in that line; if your Subscriber wishes to try the experiment I will send him his address.

T. J.

SCREW-GAUGE.

Sir,—I beg leave to trouble you with a few of my ideas in respect to the want of a screw-guage, as stated by an old acquaintance of mine at Guildford, in one of your former Numbers. I have myself long felt the want of such a guage—hardly any two manufacturers' screws agree in size, and this may account in some measure for the difference in the maker's prices, and this circumstance not only operates against

the mere respectable manufacturer, but also misleads the purchaser. Surely it would be better for the trade to fix upon a regular standard or gauge for each size, and each firm to supply their customers with a correct duplicate of that standard, for which a small charge could not be objected to, and it would prevent the recurrence of the practice alluded to. There is also a very general fault in the notching or sliting the heads of screws, which I also wish to see corrected. Many screws are slit so little in the centre of the head that the turnscrew cannot get a sufficient hold to screw them home, should they go a little tight; and by its frequently slipping out, the screw gets spoiled. The fault here complained of is caused by the workman raising and falling his back file to the edges of the screw-head. I have seen screws slit with a circular saw, by which this fault is avoided, and am surprised that this kind of saw is not more generally used in sliting screws.

I remain, Sir,
Your well-wisher
And old Subscriber,
T— J—.

Hammersmith, February 25th, 1826.

ELECTRICAL EEL.

This eel (*gymnotus electricus*) abounds in the lower provinces of Venezuela and Caraccas. It possesses the singular faculty of stunning its prey by an electrical discharge. The old road near Urutica has been actually abandoned, on account of the danger experienced in crossing a ford, where the mules were, from the effect of concealed shocks, often paralyzed and drowned. Even the angler sometimes receives a stroke, conveyed along his wetted rod and fishing line, four feet long. The sensation is highly painful, and leaves a numbness in the part affected. It resembles the effect of a blow on the head. The Indians so much dread them, that I was obliged to go myself to assist in taking them. I was conveyed to a pool of muddy, stagnant water, and soon witnessed a novel spectacle. About thirty horses and mules were immediately collected from the adjacent savannahs, where they run half wild, and are only valued at seven shillings a-head when the owners happened to be known. These the Indians hem in on all sides, and drive into the marsh; then, pressing the edge of the water, or climbing along the extended branches of the trees, armed with long bamboos or harpoons, they with loud cries push the animals forward or prevent their retreat. The gymnoti, roused from their slumbers by this noise and tumult, mount near the surface and swim, like so many livid water serpents, briskly pursue the intruders, and, gliding under their bellies, discharge through them the most violent and repeated shocks. The horses, convulsed and terrified, their manes erect, and their eyes starting with pain and anguish, make unavailing struggles to escape. In less than five minutes two of them sunk under the water and were drowned. Victory seemed to declare for the electric eels, but their activity now began to relax—fatigued by such expense of nervous energy, they shot their electric discharges with less frequency and effect. The surviving horses gradually recovered from the shock, and became more composed and vigorous. In a quarter of an hour the eels retired from the contest, and in such a state of languor and complete exhaustion that they were easily dragged on shore by means of harpoons fastened on cords. This is called, in allusion to catching fish by an infusion of narcotic plants, poisoning with horses.—*From the Journal of a recent Traveller.*

PIANOFORTE HAMMERS.

Sir,—The small wooden hammers which are made to strike the wires in cabinet and grand pianofortes, are faced with leather or woollen cloth, and work on a small brass wire, serving as a hinge or centre of motion. To prevent noise, the hole

in the centre-block of each hammer, through which the brass wire is passed as a fixed axis, is *bushed* with woollen cloth. Now I should be much obliged to any of the readers of your valuable work, if they would explain the method of putting those bits of cloth into the centre-blocks, and also the method by which the heads of the hammers, faced with leather, &c. are so neatly and smoothly cut. I have some idea of a machine in which the knowledge here requested would be serviceable.

Allow me to remark, that the French use the word *cuivre* frequently when they do not mean copper but brass, which is the case, no doubt, in the article in page 149 of your 4th volume.

I am, Sir, yours respectfully,
M. A. Corin.

PRINCIPLES OF CHRONOMETERS.

From Dr. Gregory's "Practical Mechanics."

(Continued from page 293.)

18. The weight of the balance, the strength of the spring, and time of vibration being the same, is inversely as the square of the diameter.

Hence a large balance vibrating in the same time, with the same spring, will be much lighter than a small one.

19. If the rim of the balance be always of the same breadth and thickness, so that the weight shall be as the radius, the strength of the spring must be as the cube of the diameter of the balance, that the time of vibration may continue the same.

20. If a balance be made with two balls joined by a rod, and the weights and distances of these balls from their common centre of motion be unequal, but such that each separately would vibrate in the same time; the centre of gravity of these balls will not coincide with their centre of motion, nor will they poise each other.

21. The momentum of the balance is increased better by increasing its diameter than its weight.

22. A stronger balance-spring is preferable to a weaker; because the force of this spring upon the balance remaining the same, whilst the disturbing force varies, the errors arising from the variation will be less, as the fixed force is greater.

23. The longer a detached balance continues its motion, the better.

Because, 1st, The friction in this case is less, and therefore the natural isochronism of the vibration is less disturbed. 2dly, When applied to the watch, it requires a less maintaining power, and therefore the variations in the intensity of the maintaining power will be less. 3dly, The maintaining power being less, the friction of the wheel-work will be less, and therefore the motion more regular. 4thly, The pressure on the escapement will be less, and therefore the oscillations of the balance less disturbed.

24. The greater is the number of vibrations performed by a balance in a given time, the less susceptible is it of external agitations.

25. Slow vibrations are preferable to quick vibrations: but there is a limit; for if the vibrations be too slow, the watch will be liable to stop.

If we regarded only the effect of external agitations, balances that vibrate quick should be preferred to such as vibrate slow; but they are attended with two inconveniences, greater than that which we would avoid. 1st, In two balances of the same weight and diameter, the friction on the pivot increases with the number of vibrations. 2dly, It appears by experience that the motion of the same detached balance continues longer, when its vibrations are slow, than when they are quick.

26. A balance should describe as large arches as possible, as suppose 240°, 260°, 300°, or an entire circle.

First, because the momentum of the balance is thus increased; and therefore the inequalities in the force of the maintaining power bear a less proportion to it, and of consequence will have less influence. 2dly, The balance is less susceptible of external agitations. 3dly, A given variation in the extent of the vibrations produces a less variation in the going of the machine. But care must be taken, that in these great vibrations,

the spring shall neither touch any obstacle, nor its spires touch each other in contracting.

27. The times of vibration in larger arches are sometimes shorter, sometimes longer than in less arches.

28. A uniform spiral spring may be rendered perfectly isochronal, by adjusting its length and number of spires.

This is the opinion of Mr. Berthoud. His reasoning seems to be this: if the spring forming a spiral of a certain species be so disposed, that when wound through different angles, the accelerating elastic forces of the spires, from the centre towards the circumference, increase faster than they ought to do in order to render the vibrations isochronal, it may be otherwise so disposed, namely, by making the spires approach more nearly to equality with each other in succession, that the law shall vary in such a manner, as absolute isochronism requires. But as the fundamental property of springs, namely, that *as the tension is, so is the force*, is determined by experiment, so must this property likewise be ascertained in the same manner. Accordingly, Berthoud tells us, that having attached to a balance a spiral of very large folds, making but three turns, and whose diameter was 15 lines, the angles through which it was wound being successively 5°, 10°, 15°, 20°, 25°, 30°, 35°, 40°, 45°, 60°, 120°, the counterpoising weights in grains were 10½, 21, 32, 42, 54, 65, 76, 88, 99, 134, 278. The same spring forming very small spires, making five turns in eight lines diameter, the angles through which it was wound being the same as before, the counterpoising weights were 11, 22, 33, 45, 56, 67, 78, 89, 100, 133, 250 grains. These experiments, he tells us, were made with great care; and they show that the same spiral, its length continuing unchanged, when folded in large and small spires, has a sufficient difference in its progression to vary its isochronism; when folded in large spires, according to the first experiment, the vibrations in larger arcs are accelerated; and by the second experiment, when folded in narrow spires, they are rendered slower.

29. A spiral spring may be rendered isochronal by a proper adjustment of its strength and thickness in different parts.

30. A spiral spring which is not isochronal, may be rendered such by the addition of two auxiliary springs, whose points of quiescence are properly adjusted.

This was the ingenious invention of Mr. Mudge; the theory of which construction is delivered in the Phil. Trans. for the year 1794, by Mr. Atwood.

31. The influence of the maintaining power on the balance, in restoring the motion which it loses by friction, or otherwise, may be either constant or interrupted.

This depends on the escapement; when the action of the maintaining power is constant, the escapement is called either the *recoil* or the *dead beat;* when it is interrupted, the escapement is said to be detached.

(*To be continued.*)

POTATOE DIGGING MACHINE.

Sir,—In your 114th Number you make mention of a machine, invented by Mr. Michael Barry, for digging out potatoes, by which an acre can be turned out in one hour. If such machine will do the work thoroughly, throwing the roots well on the surface of the ground, it may prove a serviceable instrument to us. I can only urge one objection against the use of this and similar machines—the poor-rates are already sufficiently burthensome, without making them more so by the substitution of machinery, when manual labour can perform the work equally well, though not in quite so short a space of time. Could my brother farmers be persuaded to continue to employ the *same number* of hands in improving their land, *with* the use of machinery, that they would have employed *without it*, then, and then only, will these improvements be ultimately beneficial to the community at large.

As to the use of this same instrument for harrowing, your description of it would not tempt me to make further inquiry after it, for I would not keep in my employ either man or boy who could not, in two-thirds of the time stated, harrow, and that well, an acre of land with two horses and a gang of harrows.

If Mr. Barry's machine can pulverise the ground with *once* harrowing, and render it of as fine tilth as it would require three, four, or even five common harrowings to perform, it will prove a great acquisition; but I very much doubt the capability of any instrument to perform such an operation. Even in that case the saving would not be a fourth part of the extent stated.

I remain, Sir,
Your obedient servant,
AGRICOLA.

P.S. In Number 116, I observe mention made of the discovery of an alkaline composition, by which wood may be rendered fire-proof, and at the same time impervious to water. Might not the application of this composition to the timbers of ships be the means of preventing that subtle destroyer of our navy—the dry rot?

FLAT ROOFS.

SIR,—Since my last to you on the subject of Flat Roofs, it has occurred to my recollection, that in the course of a correspondence with a relation, some few years since, and who was then residing somewhere in the north of England (I think Newcastle), he described to me a method which was adopted by a tradesman there in the construction of a flat roof over a stock of valuable ironmongery, and which had then been done many years without having been once repaired, with the exception of having a coat of tar laid on once in two or three years. The roof he described as being nearly level, having only sufficiency of fall to carry off the water: it was first covered with half-inch deals, close-jointed, the lengths being laid in the same direction as the fall given for the water. These boards, when laid, were well tarred over with tar and a proportion of pitch with it, a covering of large sheets of sheathing-paper was laid on these boards, such as is used for the bottoms of ships. One side of each sheet was tarred previously to its being laid on to the already tarred boards, beginning at the lower end, and on laying on the second sheet a lap was given of not less than an inch upon the first, and so on throughout. The roof being covered with paper, that was again well tarred, and covered again with half-inch deals, so laid as to break the joints of the boards below, and these were all well fastened down. Another coat of tar was put on the boards, and again covered with paper as before, which, being tacked down, was finally finished with tar, and thickly strewed with iron flakes collected from a blacksmith's anvil.

I am, Sir,
Yours respectfully,
W— C—R.

M——n.

TUBULAR CHAINS.

Perhaps some of our readers who visit in houses lighted with oil gas, may have observed lobby lamps suspended by three chains, without any tube in the middle, yet radiating with an intensity which mere unmanufactured oil, though purified to the utmost, cannot *counterfeit*. The thing looks like necromancy; and the necromancer is Mr. James Simpson, advocate, who has contrived a small brass tube, which is fastened like a chain, with links of the usual appearance, while it is really a continued pipe. Three of these chains are employed to suspend the lamp, and all of them may be employed to convey the luminous material from the ceiling to the burner, but in general one suffices, and the other two serve only the purpose of common solid chains. Mr. Simpson has taken a patent for his invention.—*From the Scotsman.*

INQUIRY.

STEAM-BOATS.

It has been so long taken for granted that the common paddle-wheels of steam-boats act to a disadvantage, that I think it is now almost time to call for a demonstration of it. I am far from believing in the assertion, and I wish the fact to be established before any new and more complex plans are proposed for "paddles with parallel motion," many of which I had seen before a single steam-boat was plying on the Thames; and all of those occasionally appearing in the Mechanics' Magazine are but inventions re-invented.

ANSWERS TO INQUIRIES.

HOW TO GET RID OF A ROOKERY.

Page 207.

Remove all the nests to the new situation, and it is more than probable that the rooks will follow.

AIR STOVES.

Page 223.

In reply to the query of C. Rogers —Let a fire be made at the bottom of the chimney, E (by withdrawing a brick or two), with wood, straw, or any flaming material, and, when the chimney is become sufficiently heated, clear out all the ashes and close the hole again; the draught will then be established, and the fire in B will continue in it, independent of wind or weather.

PURIFYING WATER.

Page 176.

Bore the bottom of a tub full of small holes, and fill it half full of charcoal coarsely powdered, on which place a layer of fine sand until the tub is within six inches of being full, then immerse it in the water to be purified to nearly its whole depth, so that the water shall be within one or two inches of its brim; in a short time it will rise through the layers of charcoal and sand, completely purified.

FLAT ROOFS.

Page 223.

The observations of W— C— are perfectly correct. I have tried the experiment, and find that even the difference of temperature between winter and summer will subject the roofs to numerous cracks.

BLEACHING.

Page 224.

It is not the *muriate* of lime, but the *oxymuriate*, or chloride of lime, which is used in bleaching; this, under the name of "bleaching powders," any druggist will obtain from the wholesale houses. Mix and stir any quantity of it (and experience must dictate how much) in clear water, and, when the powder has subsided, decant or draw off the water fine, and then immerse the linen in the latter, which will become bleached in a very short time, and it must then be withdrawn and washed well in pure water.

I remain, Sir,

Yours truly,

J. HAM.

TO CORRESPONDENTS.

We admit the justice of the objections made by our friends at Richmond, to the publication of a certain class of advertisements on our monthly wrappers, and have given directions for their exclusion in future.

"Verax" shall have an early place.

Communications have been received from G. W.—B. R****.—A Member of the Mechanics' Institution—Aquaticus—Mr. Sharpe—S. Y.—Equus—H. Frampton—T. M.—Mr. Hall.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills, Jowett*, and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

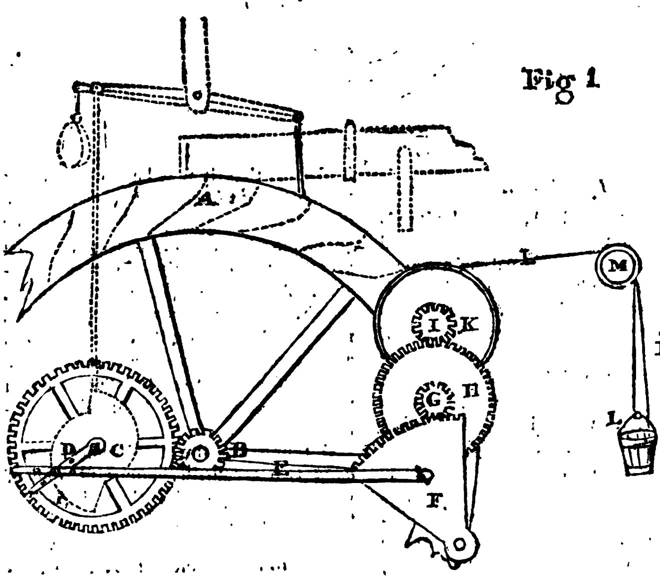
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 133.] SATURDAY, MARCH 11, 1826. [Price 3d.

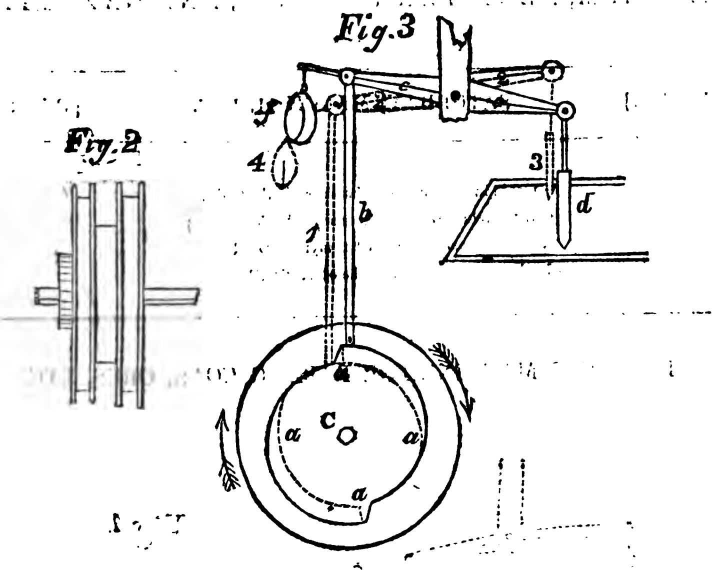
"Lull'd in the countless chambers of the brain,
Our thoughts are link'd by many a hidden chain;
Awake but one, and lo! what myriads rise!
Each stamps its image as the other flies."

IMPROVED MACHINE FOR RAISING COAL, ORES, ETC.



Sir,—The object of the improvements introduced into this Machine is to prevent the waste of power, which takes place in all the machines I have seen used for this purpose, from the necessity there is of stopping and reversing the moving power at each ascent or descent of the bucket, or of alternately throwing in and out of gear the machinery

connected with each barrel or drum, on which the rope is coiled. In my machine this is not the case, as the water-wheel, or whatever moving power may be employed, proceeds uniformly in one direction, allowing, at the same time, the buckets to be raised and lowered as usual. This is effected in the following manner:—



Description.

The water-wheel, A, moves by its pinion, B, the wheel, C, attached to and moving the segment, or part of a wheel, F (by the crank and connecting-rod, DE), alternately backwards and forwards, once during each revolution of the crank-wheel; the segment moves along with it the pinion and wheel, CH, and by working into the pinion, I, moves the drum, K, which is double (see the cross section at fig. 2), one of the ropes being wound on it, whilst the other is off, and *vice versa.* While the crank-wheel makes half a revolution, the increased motion is communicated to the drum, the rope which is on is wound off, (or that bucket descends), and the other is coiled on; when the crank passes the centre, the motion of the segment is reversed, together with that of the drum, and the rope which was before drawn up now descends, whilst the other rises. It is obvious that it may be made to draw from different depths, by altering the diameter of the drum, or lengthening or shortening the crank, so as to coil up a greater or less quantity of rope at pleasure. Attached is a piece of machinery, which, although not absolutely essential, may yet, I conceive, be employed with advantage in addition, for regulating the supply of water, &c. It is represented by dotted lines, in fig. 1, and more distinctly at fig. 3.

C represents the crank-wheel, and *aaaa* two eccentric semicircles, one of which gradually raising the rod, *b*, lifts the lever, *cc*, which lowers the sluice, *d*, and diminishes the quantity of water passing to the wheel, as the bucket rises to the top of the shaft; on passing the point *e*, the rod immediately falls, and the sluice is re-opened to admit a full current upon the wheel, when the loaded bucket is lifted from the bottom. This is shown at 1, 2, 3, 4.

As I have had no opportunity of having my machine constructed on a large scale, I cannot speak with confidence of its practical utility, although, from an inspection of the model, this does not appear doubtful. Of this, however, not being a practical mechanic, I am not so competent to judge as many of your Correspondents; from some one or other of whom (provided you favour this with a place in your Magazine) I should feel obliged by an opinion on the subject through the same medium. B. N. *

PRINCIPLES OF CHRONOMETERS.

From Dr. Gregory's "Practical Mechanics."

[Continued from page 318.]

32. By *escapement* is understood the means by which the action of the wheels is applied to maintain the vibration of the balance; and it consists of the balance-wheel and pallets.

33. Pallets are small plates or levers attached to the axis or verge of the balance, which receive the impulse of the balance-wheel produced by the maintaining power, and thus continually renew the motion which the balance loses by friction, or other resistance.

In a *recoil escapement*, when one tooth of the balance-wheel drops off the first pallet, the other acting tooth falls on the inclined plane of the other pallet, which, meeting it obliquely, causes the balance-wheel to recoil, from which circumstance this escapement derives its name.

In the *dead-beat escapement*, when one tooth of the balance-wheel drops off the inclined plane of the first pallet, the other acting tooth immediately falls upon the convex surface of the other pallet, which surface being concentrical with the axis of the balance, the wheel continues at rest until, by the motion of the pallet or cylinder, the inclined plane of the tooth comes to act upon the face of this latter pallet or edge of the cylinder, which then, by its pressure on that edge, throws the cylinder round, and thus gives motion to the balance; then instantly entering the cavity of the cylinder, it falls upon the concave surface, and for the same reason as before continues at rest, until the balance-spring drives the cylinder round in a contrary direction to what it did before, so as that the inclined plane of the tooth may act on the second edge of the cylinder; which pressure throws the cylinder round in the contrary direction, and the tooth gets out of the cavity, and at that instant the subsequent tooth falls upon the convex surface, and so on. From the quiescence of the balance-wheel during the interval of time that elapses between the falling of the acting tooth on the surface and its pressure on the edge of the cylinder, this escapement is called the *dead-beat*.

In the *detached escapement* the motion of the maintaining power is suspended during almost the whole time of vibration; just at the end of the return of the balance it unlocks the wheel-work, and a tooth of the balance-wheel immediately acting on the pallet, restores the motion which the balance had lost, and having given its impulse, the wheel-work is instantly locked again, and the balance performs its vibration freely and disengaged from all other parts of the machine.

34. In the escapement of recoil, the vibrations are quicker than if the balance or pendulum vibrated freely. For the recoil shortens the ascending part of the vibration by contracting the extent of the arc, and the re-action of the wheel accelerates the descending part of the vibration.

35. In the dead-beat escapement the vibrations are slower than when they are performed in a detached state.

For the pressure of the tooth on the surface of the cylinder retards that part of the vibration which is performed while the cylinder, by the motion of the balance-spring, re-

* We have to apologise to our ingenious Correspondent for the length of time this article has stood over; it arose from an accident connected with the drawing, which we have only very lately been able to remedy.

volves so far as to bring the tooth to the edge of the cylinder; and if the maintaining power be increased, the pressure of the tooth on the cylinder may become so great as entirely to stop the motion. When the tooth has communicated its impulse to the edge of the cylinder, it moves almost freely; and as the tooth does not yet press with its entire force on the next surface, the cylinder will indeed describe a larger arc, and therefore, on that account, the time may be shortened; but, when it has consumed all the impulse of the wheel, it returns by the sole force of elasticity; now the pressure of the tooth causes a friction which diminishes the tendency to return to the point of rest, so that the balance performs its vibrations slower.

36. In the escapement of recoil, if the maintaining power be increased, the vibrations will be performed in larger arches, but in less time.

Because the greater pressure of the crown wheel on the pallet will cause the balance to vibrate through larger arches; and the time, on this account, will be less increased than it will be diminished by the acceleration of the balance by that pressure, and the diminution of the time of recoil.

(To be continued.)

METHOD OF ASCERTAINING THE WEIGHT OF A COPPER ROLLER USED BY CALICO PRINTERS, BY MEASUREMENT.

The internal diameter at one end is 3 inches, the internal diameter at the other end is $2\frac{7}{8}$ inches, the external diameter is $4\frac{1}{8}$ inches, and the length 32 inches: the mean between the internal diameters is 2.9375 inches. Now, by the mensuration of cylinders, $\overline{4.125^2 - 2.9375^2} \times .7854 \times 32 = 211$ cubic inches, the quantity of copper in the roller. By the table of specific gravity we shall find that of copper to be 8900; *i.e.* one cubic foot of copper weighs 8900 avoirdupois ounces: then, by proportion, 1728 : 8900 : : 211 : 1087 ounces = 67 pounds 15 ounces, for the weight of the roller. The same roller was actually weighed, and found to be $69\frac{1}{2}$ pounds; out of this difference we must make an allowance for a small projection of copper affixed to the inside of the roller, which is not taken into the measurement.

JOSEPH HALL.

Harpurhey.

RIVER NAVIGATION.

SIR,—Although the answer of Henry Russel (vol. v. p. 156) to the Inquiry of A. B. (p. 102) may be correct, as far as it goes, yet I conceive it is very likely to mislead A. B. or any others unacquainted with the subject; for, the fact is, there is no barge navigating the River Thames without oars or sails, whose course is not principally directed by the use of poles of different lengths, varied according to the depth of water; for it is well known by every bargeman on the River Thames, that the rudder alone is quite insufficient to keep the barge in the proper channel.

I am, Sir,
Respectfully yours,
AQUATICUS.

SAFETY-GIGS.

SIR,—The different degrees of ability found among men, may perhaps be classed under three heads:—the original or inventive; correct imitations of the best models; and the art of demolition, or that of finding faults, or supposing faults to exist, where there are none. Of this last class would be a blacksmith, who with one blow of his hammer should destroy a beautiful clock; he might pride himself on his ability, and his feat create a momentary laugh, but certainly admiration could go with him no further. In your 129th Number there is an exceedingly fierce attack on Matthews's Safety-Gig, the account of which appeared in Number 124. This attack justifies the foregoing remarks.

The original observations on the gig say—"The fall of a horse pro-

pels the seat of a common chaise or gig forward twelve inches, with a velocity which, with the ten miles an hour, at which rate it may be going, gives to the body of a loaded gig a force nearly equal to two tons; and this, taking place at the instant a horse is recovering from his trip, seldom fails to throw him down."

The corrector of these *mis-statements*, as he is pleased to call them, asserts, that, because "a well-constructed gig bears only thirty pounds on the back of a horse, it is all the resistance, *he conceives*, there is to his recovery, and that, consequently, there could not be more than that force acting on him at the time of tripping." These remarks are altogether incorrect, or, according to his own language, "not founded on truth." Indeed, he goes on to contradict them himself; for he is obliged to allow "that the force is in proportion to the weight and velocity jointly." Now, the impetus which the velocity imparts to this weight is not on the horse's back, as he supposes, but in a forward direction. He proceeds to say, that "the force occasioned by the velocity operates the same in Matthews's gig as in all others." This appears plausible, but is not correct; for in the safety-gig there is only the simple velocity of the horse; in all others the fall of the horse propels the seat twelve inches forward, with a velocity which sometimes greatly surpasses that of a common hammer in driving a nail; and *this dart* in them must be added to the speed of the horse. It is repeated, that this cannot happen to the safety-gig, and this alone will stamp its superiority. For if a hammer of 1 lb. weight, with the same velocity, falling only 12 inches, will force a nail where 10 lbs. dead weight would not, it must then be evident, that a loaded gig, weighing four hundred weight, having received the same velocity, will also be more than equal to ten times its weight if at rest, or "two tons!" "Mark that, Mr. Editor."

After further amusing himself with other mistakes of his own, your Correspondent says he will return to the safety-gig; but instead of doing so, he gives a long paragraph, in endeavouring to prove that it is better to go ten miles an hour with a brisk or lively horse, than five miles with a sluggish or tired one. Marvellous sagacity this! Who doubts it? or what has that to do with the safety-gig? If he intends to insinuate, that a horse going at a quick rate never falls, the public know better; and that it is such falls which mostly prove fatal. To allow of a quick pace without this danger, remains only with the safety-gig.

The next thing in the original description that he endeavours to ridicule is the following:—"No conceivable strength or weight of iron, or timber, if attached to the shafts, can be sufficient to sustain the weight of a horse moving at a great rate." He supposes, that the person describing this intended to say, "falling on them (the shafts);" but his supposition in this, as well as in every other particular, is wrong. What was really meant by the original, was an allusion to the various attempts of numerous coachmakers to guard against accidents, by causing the steps nearly to reach the ground, or by attaching sundry other kinds of props to the shafts, the body, or elsewhere. None of these devices allowed the shafts to yield to the motion of the horse; so that if such props merely struck against a hillock, at full speed, "*no conceivable strength*," as thick even as the leg of the horse, would prevent their being broken, and the occupants of the gig from being thrown out. Such "*remedies*" as these, which are, indeed, "*worse than the disease, have been thought of by almost every man in the coach business*," "*but found not worth putting into practice.*"

This corrector of the public judgment cannot, or pretends not, to discover the vast difference between all these and the safety-gig, which does not, and never can, cause any concussion whatever. He cannot perceive the difference between striking (or a contact that takes place at the end of a motion), and placing (or a contact which takes place without

any previous motion) in the safety-gig. The transfer of weight from the spring to the sledge on the ground, takes place without any perceptible movement, and consequently without any concussion, when the front part slides upon the ground like a sledge, which is the easiest of all motions except skating, and which it much resembles.

Now, Mr. Editor, "for the practicability of this contrivance." The corrector says it will not answer. It was said to the boy who had committed a minor offence, "They cannot put you into the stocks." "But," returned he, "they have done it." Three persons *have* rode in one of these safety-gigs, and, with the exception of once, when the horse tripped, the irons never touched the ground on the turnpike-road, nor yet in going along a lane full of deep ruts, save where the wheels descended into holes, or in crossing from one side to another. These irons did then slide on the ground, but without giving any jerk; in fact, it administered a uniform equality of motion, remarkably superior to that which would have taken place with wheels only. The horse had no difficulty in getting the wheels out of holes a foot deep. The ease to the horse was caused by part of the weight at such time resting on the high ground, and consequently leaving less quantity to be lifted from the hollow.

As all the objection your Correspondent can find to the practicability of "*this surprising invention*" consists in the irons knocking against the ground, therefore if that does not exist, then there are none, according to his own showing. This also is above his "*comprehension*," that these irons must be stationary, even if the springs should vibrate ten inches; for in consequence of the front body spring being removed, the remaining front springs have only half the play of those behind; so that the same force or weight that lowers them three inches, at the same time lowers the hind springs six inches. The effect of this is to raise the front of the sledge or safety-irons three inches, and this being exactly the same, the front springs lower them; they are in consequence uniformly preserved in the same station, even with the most elastic springs, on the worst of roads.

There is one more observation to be noticed, which is directed against the *elegance* of the safety-gig. This may be considered a grave charge; for if it be proved, it is not likely ever to be endured as a fixture to a gentleman's carriage. But what is elegance? "that's the question." Is Corrector able to tell? *A real* coach-maker perhaps would have known that it is not merely to paint or varnish, but chiefly to scroll-irons, compass-work, whip-springs, &c. that the gentleman's carriage owes its superior appearance to the "*coster-monger's cart*." Had your Correspondent been an artist, or a man of taste, he would have understood Hogarth's line of beauty, and he would then have been able to discover it in the safety scroll-iron; and that in its assimilation to that most elegant curve lately introduced into the fashionable shafts, it really does harmonize with them, and consequently confers elegance on the safety-gig. The squat, angular form of the present gigs require some such relief.

The inventor of the safety-gig, "with or without his spectacles," may perhaps claim the right of giving his opinion on subjects, when it is known that he followed the profession of an artist long enough to gain a leaf of laurel from the topmost twig. Towards the end of the last century, he exhibited in one season seventy-two original portraits; one of which was pronounced by Mr. Opie, at the public dinner, to be the best portrait among the miniatures of that year. Had this same inventor of a gig possessed no true conceptions of elegance, Bishops, Judges, Admirals, numerous Nobility, and Lords of the Council, would not have sat to him.

I am, Sir,
Your obedient servant,
H. M.

Bethnal-Green.

MEASURING THE CONTENTS OF CYLINDRICAL VESSELS.

SIR,—The following easy method of ascertaining the contents of *any cylindrical vessel*, in gallons, was communicated to me by the late Dr. Evans, the mathematical master of Christ's Hospital; but, as it applied to the *old gallon*, I shall be obliged to any of your mathematical friends who will be good enough to give me a *fractional multiplier* that will answer the purpose for *the imperial gallon*.

I have a long time employed this rule to verify my purchases of *oil*, and it has saved me money by detecting errors; and I hope, when known, it will be of service to others.

CAY ESS.

West Brixton.

Rule.

Multiply the diameter of the cylinder by itself; that product multiply by the depth *in inches* and decimal parts; lastly, multiply this last product by the decimal ,0034, and from this product cut off as many figures as there are decimals in the whole, and the figures or whole numbers are gallons, and the decimals are parts of a gallon.

Example.

Suppose a cylindrical vessel to measure 21,5, say twenty-one inches and a half diameter; and the depth of the oil or other fluid is 76,25 inches, say seventy-six inches and a quarter.

Multiply . . .	21,5, the diameter,
by itself . . .	21,5
	1075
	215
	430
	46225
Multiply by the depth .	76,25
	231125
	92450
	277350
	323575
	352466625
Decimal fraction . .	,0034
	1409862500
	1057396875
	119,83831250

	gals.	qts.	pints.
Answer . . .	119	3	$0\frac{1}{2}$

One hundred and nineteen gallons, three quarts, and one half-pint.

N.B.—To measure the depth of the fluid you should have a rod marked with inches and parts, but any plain rod dipped into the fluid, and accurately measured to the point of immersion, will be sufficiently accurate.

CULTURE OF THE SILK-WORM.

Abstracted from a Pamphlet by JOHN MURRAY, F.L.S.

The insect, from which silk is procured, reposes motionless for the period of nearly six months, in a minute round body called the *ovum*, or egg. From thence it springs, under the form of a little elongated animal with eight pairs of feet, a caterpillar, or *larva*. This caterpillar, improperly called silk-worm, feeds on the leaves of the mulberry. It increases rapidly in size; so much so, that its skin in six or seven days after birth cannot contain the internal organs. In its turn, this skin bursts, and the little insect comes forth in a new dress, advancing towards another stage of maturity for seven days more. There are altogether, under this state of being, four distinct changes of skin. When the silk-worm feels that it is about to quit its fifth skin, it looks out for a secure and retired situation, and there constructs a dormitory, where it may be safe from external contingencies. It then spins its silken web, disposing it in such a manner as to leave an oval cavity within. This ball is called the *cocoon*. The larva casts off its last skin in this abode, to become a being of another order, and altogether different from the appearance it had before assumed. In this singular form, in which it somewhat resembles a child in swaddling bands, it is called *crysalis*, *aurelia*, or *nympha*. In twenty days after the transformation of the larva or caterpillar into the crysalis or aurelia, entirely effected within the cavity of the silken cacoon, we may perceive, at length, a little insect, plumed with white wings, burst from the cocoon. This is the *imago*, or winged state of the animal, called phalena, or moth—the most perfect state of this strange microcosm. The moth soon lays eggs: these (about six months after) in their turn, again produce larvæ. This larva spins the cocoon, and the same interesting circle of changes is thus repeated.

Henrietta Rhodes, in a communication to the "Society of Arts, Manufactures, and Commerce," says, that a fibre of silk, unwound from the cocoon, extends 404 yards: when dry it weighs three grains. One lb. avoirdupois is equal to 535 miles in length, and 47 lbs. would thus encircle the globe. The silk, as spun by the insect, is in the form of fine threads, or fibres, which vary in colour, from white to reddish yellow. It is very elastic, possessing considerable strength, and covered with varnish, to which its elasticity may be imputed. This varnish being soluble in boiling water, but insoluble in alcohol, has somewhat of the nature of gum, or perhaps rather of a nature intermediate between *gum* and *gelatine*. The silk imported from China is always *white*, and apparently of a stronger, rougher, and coarser consistency than that from Bengal, which is yellow. The Italian silk is generally yellow.

It seems very strange that the cultivation of the silk has hitherto been so limited in Europe, from an absurd notion that the climate, in particular localities, is unfavourable. By Count Dandolo's process, however, we manage the treatment with as much, or greater certainty, than we do the cultivation of grapes for the market; and what a curious and interesting appendage might not this form to the stoves and conservatories in gentlemen's gardens, where the artificial heat that serves for the exotic plants, would exactly suit the culture of the silk-worm, and where, too, a few mulberry trees might be forced, in pots, or boxes—(See Mr. Knight's observations on the mulberry in the Transactions of the Horticultural Society of London)—contemporaneous with the evolutions of the insect to meet its infant wants, till the open ground, about the 1st of June, would furnish a sufficient supply? The whole process occupying only 36 or 37 days, or little more than a month. There is another consideration deserving particular attention, and that is, the probability of *naturalizing* the silk-worm, and obtaining a hardier brood. Great Britain differs not more from France and Italy, than these do from the Oriental climes, whence the silk-worm first sprung, and where it is indigenous. The *Aucuba Japonica*, *Corchorus Japonica*, and other congeners, have, in this country, been once the inmates of the green-house, but they are now found to grow luxuriantly in the open ground, and in situations the most exposed. The same thing may be said of the *Camelia Japonica*,* did their expense not preclude the experiment. Be this reasonable speculation of naturalization as it may, we can introduce the silk-worms into an artificial climate, and manage them with most complete success.

At Sion, last summer, I had a good deal of interesting conversation, on the subject of the silk-worm, with Mons. George d'Escher de Berg, jun., Chateau de Berg, near Schaffhausen on the Rhine. I acknowledge myself much indebted to

* Even in the case of the Pine-apple, as Mr. Knight has shown in the Trans. L. H. S., we have been too profuse of our artificial temperature.

his intelligence and courtesy.* He informed me, that the cultivation of the silk-worm was introduced with growing success into Oberland, under the auspices of an Agrarian Society at Zurich, of which he is an honorary member. He added, *inter alia*, that they were indebted to the north of Italy for the supply of leaves of the mulberry to feed the insect in its earliest stage of growth. I explained to him Count Dandolo's method of culture, which he exceedingly admired, and suggested a trial of the leaves preserved in close vessels to the exclusion of air—the powder of the dried leaves—and, finally, forcing a few pots of mulberries by artificial heat, or by covering the plants with awnings, &c.

The eggs are at first strewed on shallow trays of paper of a convenient size. Brown paper, or white laid wire paper is decidedly the best, since that which has undergone the destructive process of bleaching might prove injurious, if not fatal. The mulberry leaves (those of the white mulberry are by far preferable) are at first chopped small, and strewed over the trays. The caterpillar is, in its second or third stage, &c. transferred to larger and more commodious trays, and an increased supply of food given, proportioned to their size. At first, the compartment is small, then the caterpillar is removed to rooms of a larger size; while the heat, at first, about 72 deg. F., gradually declines to 69 deg.

The cocoons, when intended for silk, are thrown into boiling water, to destroy the included *nympha*, and then carefully dried by a stove heat, or in an oven. Those intended for the future crop are strewed over a coarse linen cloth, extended on a table in an unused room. It is stated that an *obscure* or darkened room is best adapted for this purpose; and the habits of the family of the *Phalenæ* seem to sanction the conclusion. From each pound of cocoons (male and female), according to the principles stated by Count Dandolo, two ounces of ova may be obtained; whereas he mentions, as comporting with his knowledge, that, from bad management, in many parts of the country, not unfrequently 10, 20, and even 30 lbs. of cocoons, have been sacrificed for a single ounce of eggs. When the extremities of the cocoon remain less abundantly supplied with silk, and it is confusedly disposed, the concealed *nympha* within may be considered perfect and sound.

The female *nymphæ* weigh about twice as much as the males, and thus the female, all circumstances being alike, ought to be larger than the male cocoons. The other modes of discrimination are equivocal or fallacious, and even this test is only to be considered as a general guide or approximation to truth. One hundred males weigh seventeen hundred grains, and one hundred females three thousand grains. A proper number of each being selected, the cocoons intended for the production of the moths are placed on the cloth (as before mentioned), in a room, the temperature of which does not exceed 72 degrees F.—a higher temperature, though it might cause their earlier evolution, would injure their healthiness; and if the principles of the Count are adhered to, the cocoons will be always healthy. Stillness and decreased light will be found favourable circumstances. The moths having deposited their eggs on the coarse cloth prepared for this purpose, soon die; the ova adhere by a gummy matter to the cloth. The temperature is reduced to about 66 degrees F.; and when the ova, after remaining a few days, have acquired an ash colour, the cloth extended on a frame may thus be removed to a cool apartment, where it is necessary they should be preserved dry. The eggs when required are easily detached by immersing the cloth in fresh water, which dissolves the mucilage, and they are then carefully and properly dried.

The obtainment of the silk from the cocoons, consists in collecting the various threads, winding them on reels, taking care that the cocoons severally unwind freely through all their extent. In order the more easily to obtain this end, the cocoons are thrown into caldrons containing water heated to nearly the point of boiling. The various threads are then collected together by means of a whisk or brush, and are thus attached to a reel, passing through plates of steel, &c. being wound by particular machinery attached to a water-wheel. When the water is pure, and the more it is preserved clean in the boiler, so much the more beautiful and abundant is the product, because the water otherwise becomes discoloured, from the decomposition of the chrysalidæ that fall to the bottom. Gensoul of Italy, has invented an apparatus, by means of which the water is heated through the medium of steam, and the nymphæ that fall are collected on a grating of iron wire at the bottom of the boilers, which is frequently raised for the purpose of removing the husks. By this ingenious method much fuel is saved, one furnace with its boiler serving to heat twenty vessels, and from the decreased temperature the cocoons do not suffer any decomposition or change, as is the case in the ordinary way, wherein they are immediately exposed to the direct agency

* M. d'Escher de Berg informed me, that he had made trials with the *Phormium tenax*, or New Zealand flax, in his garden.

of the fire. Another saving might still be effected by this method, in the substitution of vessels or cisterns of wood for boilers of copper. In the month of August last, at Buffalora, on the Milanese frontier, I visited an establishment for unwinding the silk. Women were arranged in two rooms, opposite each other, and conducted the process. The cocoons contained in baskets on one side were thrown by handfuls into caldrons of water, kept boiling by charcoal fires beneath. Each by a whisk (of peeled birch) collected the threads *en masse*, the first confused portions were rejected, till the threads unwound regularly, freely passing over glass rods to prevent the injuries of friction. The first portions are necessarily useless, and are separated by the hand. When the threads came off uniformly, the cocoons were raised suspended to the hand by their respective threads, and thus handed over to those on the opposite side, who, in their turn, threw them into caldrons of water, the temperature of which was nearly that of blood heat, and more than milk warm—thus sustained by a steam-pipe. The water was thus kept clean, and the silk preserved pure and unsoiled. From these the threads were finally wound. The proprietor informed me that this establishment cost 60,000 francs.

Those cocoons that are white, or of a very light yellow, are esteemed the best. The cocoons are required to be kept in boiling water about three hours (steam, I should think, by far the safest mode, and decomposition would be prevented) to kill the nymphæ within. The leaves of the white mulberry are preferred, and will cost on an average about two soldi the libra grosso.

The young mulberries in Piedmont are generally defended by a rope of straw or hay twisted round the stem.

At Novara, I was informed that sometimes nearly 100 lbs. of cocoons were obtained from the ounce of ova, and that this season proved favourable. There, the leaves cost about 1 soldo per lb.

At Varese, one ounce of ova was computed to yield from 45 to 60 lbs. of cocoons—5 lbs. of cocoons were estimated to produce 1 lb. of silk. One pound of silk thus obtained was stated to be worth 24 *lire Milanese*. In one instance, I paid a franc for what weighed, on the 7th November, 46 grains, and another portion, which cost a franc and half, at Varese, weighed 175 grains. The ova seemed good, being mostly of an ash colour, and but few, comparatively, yellow grains. Four grains weight of mixed ash and yellow ova I ascertained contained 396 ova. One hundred ash, or impregnated ova, weighed 8 grains; one hundred yellowish or unimpregnated ova weighed 7 grains; so that each grain containing about 100, there will be in an ounce Troy about 48,000 ova.

On inquiry at Milan, on the 6th of August, I was told that silk was dearer this year than last, owing to the chilling winds from the Alps, and wet, in the early part of the season. Last year, the raw silk cost 45 francs—the present year, it was valued at from 50 to 65 lire Milanese per lb. of 28 ounces. The white is always most esteemed. At Vicenza, much silk is cultivated, and besides its introduction into Switzerland, I was told that Hungary, &c. now boasted of the advantage. Almost all the silk cultivated in the Lombardo-Venetian kingdom, is sent to France to be manufactured!

When at Baveno, on the *Lago Majiore*, I was informed by the landlord of the inn where we resided, that he raised this season about 400 lbs. of cocoons, and that the year was a good one. They feed the silk-worm here also on the leaves of the white mulberry, which cost from 1 to 2 soldi per lb. *grosso*. Females, at this place, are in the habit of wearing the ova, for two or three days, wrapped up in cloth, next the skin. The ova here were estimated at 10 francs per ounce, and each ounce calculated to produce about 100 lb. (libra grosso di Milano). Almost every poor family rears the silk-worm.

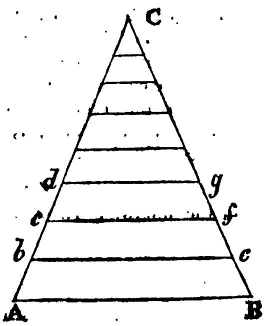
SECTORAL LINES.

Sir,—In pursuance of the hint given by G. A. S., I now proceed to give a brief explanation of the Sectoral Lines; and I hope that what I may say in their regard will do away the difficulty which any of your readers or Correspondents may have found in the use of the Gunter or Plain Scale, inasmuch as the sector, in the full extent of its construction, contains *all* the logarithmic and trigonometrical lines to be found on either of them, while its line of lines supplies a universal scale of parts of far more extensive application than the particular scales upon the others.

The line of numbers has been ably treated by G. A. S., and I need not waste my own time and your space in a recapitulation. I shall, therefore, in the first instance, confine myself to those lines which are properly sectoral, viz. the *double lines*, or those cut upon *each* leg of the ruler. But the *principle* from which the use of the sector is derived, ought, before all, to be shown. It is simply this:—

"In any given Δ, if a line be drawn parallel to *one* of the sides, it cuts the

other sides, or the sides produced, proportionally; and the part of the parallel, intercepted between the sides, is itself in the same proportion to its parallel as the other segments to their



respective sides." So that if the $\triangle$ be isosceles; C its vertex; CA, CB, its legs; and bd, cf, &c. ∥ lines to AB, we have CA : CB : BA : : Cb : Ce : eb, &c. If, therefore, CA (= CB) = 10, and AB = 5, and eb = 4, then 5 : 10 : : 4 : $\frac{4 \times 10}{5} = 8 = b$C or eC. Let CA, CB, be similarly divided, *i.e.* in the same proportion, so that whatever part Cb, &c. is of CA, Ce, &c. is the *same* part of CB: then, from what has been said, it is manifest that eb, &c. is the very same part of AB, and this is the whole secret of the sector—all that is required to enable us to use it properly, if only we are acquainted before-hand with the nature of the several lines. For the $\angle$ ACB may have any compass, from the close of the instrument to its full opening; the segments of the sides are invariable, and the transverse distances, eb, fc, &c. continue to have towards each other and the base AB; the ratio, whatever it is, of these, is variable segments. That is, if CA be 10, and CB be 9, then how great or how small soever AB may be taken, the next transverse eb will be 9-10ths of it, and so for the rest.

I shall now take the *line of lines*, show how it is to be drawn, and what are its uses; and I shall pursue the same steps with each of the others. The line of lines consists of *two* scales of equal parts, equal, and similarly divided, one lying on each limb of the sector: it is marked Lin. or simply L. These two lines, as well as all the double lines, converge until they meet in the very central point of the centre of motion of the instrument. Each of those in question is divided into *ten* equal parts; each of these divisions also into *ten;* and the subdivisions, according to the actual magnitude of the scale, are bisected or quadrisected. The use or application of the scale is twofold, either geometrical or arithmetical. First, we can divide a given line into any number of equal parts, say 7; take the given line in the compasses, open the sector until the compasses exactly reach from 7 to 7 on the scales; take the distances from 6 to 6, 5 to 5, &c. and set them off severally on the given line. It is evident from the elementary figure, that, if the sector be true, the division must be correct. In the same way we may cut a given line in any required proportion of its parts. Suppose the proportion of the parts, the whole line is expounded in figures by their sum, or 16. Take its extent, and make it *a transverse distance* at 16 on the scales. The transverse distance at 9, or at 7, set off on the given line, will satisfy the conditions. Having spoken of transverse distances, it must be noticed that an extent taken upon the divided legs of the scale is termed a "lateral distance," while an extent taken by stepping across from one leg to the other is termed a "transverse," or a "parallel distance."

This may be enough to show the geometrical uses of our scale; at least, the student, if he be not extremely simple, will easily, of his own head, learn to apply it to any other case of division which may occur in practice, though some questions which may seem to be here omitted, will be explained under the head of arithmetical applications. These, as well as the uses of the other lines, will be the subject of future communications, which I hope to arrange and remit without the delay which has kept back the present.

MONAD.

HOW MANY FIFTEENS IN A PACK OF CARDS?

SIR,—The following Question on the doctrine of Combinations, has lately appeared in most of the public journals:—How many Fifteens can be made from a Pack of Cards?

Various answers have been given to this question, but none of them (as far as I have seen) is correct. If you should think the following solution worthy of a place in your valuable Magazine, you will oblige me by inserting it.

Rule for finding the Combinations.

Let r = the number of cards to make the given number; then, if all the cards are of different numbers $(4)^n$ = combinations. Thus, for example, suppose 1, 2, 3, 4, 5; then $(4)^5 = 1024$ combinations. If two of them should be of the same number $(4)^{n-2} \times 6$ = combinations. Suppose 2, 3, 5, 5, then $(4)^2 \times 6 = 96$ combinations. If there be 3 of the same number $(4)^{n-3} \times 4$ = combinations. Suppose 2, 2, 2, 3, 6, then $(4)^2 \times 4 = 64$ combinations; or if there should be 2 of the same number, and 3 of another, $(4)^{n-5} \times 6 \times 4$ = combinations; thus 1, 1, 2, 2, 2, 3, 4, then $(4)^2 \times 6 \times 4 = 384$ combinations. Lastly, if there should be 4 of the same number, these 4 can only admit of one combination; so that the combinations must be calculated from the remaining cards. Suppose 1, 1, 1, 1, 2, 2, 3, 4, then $(4)^2 \times 6 = 96$ combinations.

From the above premises, the calculations in the following Table will be evident.

	Order.	Combinations.
10	5	16
	4, 1	64
	3, 2	64
	3, 1, 1	96
	2, 2, 1	96
	2, 1, 1, 1	64
		400

That is, by using the 4 tens, there will be 400 combinations; but as King, Queen, and Knave each count 10, ∴ 400 × 4 = 1600, number of combinations with a King, Queen, Knave, and ten.

	Order.	Combinations.
9	6	16
	5, 1	64
	4, 2	64
	4, 1, 1	96
	3, 2, 1	256
	3, 3	24
	3, 1, 1, 1	64
	2, 2, 2	16
	2, 2, 1, 1	144
	2, 1, 1, 1, 1	16
		760
8	7	16
	6, 1	64
	5, 2	64
	5, 1, 1	96
	4, 3	64
	4, 2, 1	256
	4, 1, 1, 1	64
	3, 3, 1	96
	3, 2, 2	96
	3, 2, 1, 1	384
	3, 1, 1, 1, 1	16
	2, 2, 2, 1	64
	2, 2, 1, 1, 1	96
		1376
7	7, 1	24
	6, 2	64
	6, 1, 1	96
	5, 3	64
	5, 2, 1	256
	5, 1, 1, 1	64
	4, 4	24
	4, 3, 1	256
	4, 2, 2	96
	4, 2, 1, 1	384
	4, 1, 1, 1, 1	16
	3, 3, 2	96
	3, 3, 1, 1	144
	3, 2, 2, 1	384
	3, 2, 1, 1, 1	256
	2, 2, 2, 2	4
	2, 2, 2, 1, 1	96
	2, 2, 1, 1, 1, 1	24
		2348
6	6, 3	24
	6, 2, 1	96
	6, 1, 1, 1	24
	5, 4	64
	5, 3, 1	256
	5, 2, 2	96
	5, 2, 1, 1	384
	5, 1, 1, 1, 1	16
	4, 4, 1	96
	4, 3, 2	256
	4, 3, 1, 1	384
	4, 2, 2, 1	384
	4, 2, 1, 1, 1	256
	3, 3, 3	24
	3, 3, 2, 1	384
	3, 3, 1, 1, 1	96
	3, 2, 2, 2	64
	3, 2, 2, 1, 1	576
	3, 2, 1, 1, 1, 1	64
	2, 2, 2, 2, 1	16
	2, 2, 2, 1, 1, 1	64
		3624
5	5, 5	4
	5, 4, 1	96
	5, 3, 2	96
	5, 3, 1, 1	144
	5, 2, 2, 1	144
	5, 2, 1, 1, 1	96
	4, 4, 2	96
	4, 4, 1, 1	144
	4, 3, 3	96
	4, 3, 2, 1	1024
	4, 3, 1, 1, 1	256
	4, 2, 2, 2	64
	4, 2, 2, 1, 1	576
	4, 2, 1, 1, 1, 1	64
	3, 3, 3, 1	64
	3, 3, 2, 2	144
	3, 3, 2, 1, 1	576
	3, 3, 1, 1, 1, 1	24
	3, 2, 2, 2, 1	256
	3, 2, 2, 1, 1, 1	384
	2, 2, 2, 2, 1, 1	24
	2, 2, 2, 1, 1, 1, 1	16
		4388
4	4, 4, 3	16
	4, 4, 2, 1	64
	4, 4, 1, 1, 1	16
	4, 3, 2, 2	144
	4, 3, 2, 1, 1	576
	4, 3, 1, 1, 1, 1	24
	4, 3, 3, 1	144
	4, 2, 2, 2, 1	96
	4, 2, 2, 1, 1, 1	144
	3, 3, 3, 2	64
	3, 3, 3, 1, 1	96
	3, 3, 2, 2, 1	576
	3, 3, 2, 1, 1, 1	384
	3, 2, 2, 2, 2	16
	3, 2, 2, 2, 1, 1	384
	3, 2, 2, 1, 1, 1, 1	96
	2, 2, 2, 2, 1, 1, 1	16
		2856

	Order.	Combinations.
	3, 3, 3, 2, 1	16
	3, 3, 3, 1, 1, 1	4
	3, 3, 2, 2, 2	16
3	3, 3, 2, 2, 1, 1	144
	3, 3, 2, 1, 1, 1, 1	16
	3, 2, 2, 2, 2, 1	24
	3, 2, 2, 2, 1, 1, 1	96
	2, 2, 2, 2, 1, 1, 1, 1	4
		320

Hence combinations with a King, Queen, Knave, and ten...... 1600
9 760
8 1376
7 and no higher card 2348
6 3624
5 4388
4 2856
3 320

In all.................... 17,272

I remain, Sir,

Yours most respectfully,

G...... S......

BOOK-BINDING.

Sir,—It frequently happens that the bands of books break entirely off by a very moderate use. The accident, I believe, does not admit of a perfect cure without binding the volume anew, and that sometimes is impracticable, when the margins have been cut close in former binding, or, as is not unfrequently the case, have manuscript remarks scattered in them. I have thought a little upon the subject from experiencing the inconvenience of the accident alluded to, and shall be much gratified to know if the following or any better plan has ever been put in practice.

The plan I propose is, to coil a small wire round a pin very closely (varying the thickness of the pin to suit the size of the book, viz. whether folio, quarto, &c.), and cover that wire with leather or India rubber; this, when the pin is drawn out, makes a flexible tube, which may be cut into proper lengths for the back of the book intended to be bound, and, when bands are run through them and fixed in the sewing-frame, the sheets may be sewed upon them as well and as firmly as upon the bare bands. By this method, if any of the bands happen to be broken or damaged, they may be easily drawn out and others substituted without the inconvenience of having the whole of the work to cut open and sew afresh, and thus the leaves are guarded from the injury they must necessarily sustain by the old practice, besides having the advantage of abridging the labour and care of the workman.

I am, Sir,

Yours respectfully,

Robin Raw.

February 6th, 1826.

CALLING THE HOURS.

SIR,—I apprehend that your Correspondent, Ægrotus, in a late Number, is a little unreasonable, like some other sick people, in his expectations from those about him; and that, what with the wind, their drowsiness, unwillingness, forgetfulness, and accents, *cum variis aliis*, a mess would be made of the hours by our friends the *Charlies*, as grating to the spheres, as to those who, revolving in their beds, sigh rather for the crowing of the cock, or the caroling of the lark, than for any clear intelligence of the leaden feet of Time. As what is "good for the goose is good also for the gander;" what says your Correspondent to the extension of his plan to Italy, where the hours of the night are counted in succession to those of the day; and twenty-two, three, and four, are ordinary answers to your inquiries concerning the steps of the flowery-footed hours. So far from increasing, with Ægrotus, our friends' duties in the bawling line, I, who am also a nervous, restless, and extremely uncomfortable man, would suggest the total abolition of that detestable practice, and the substitution, if *we must* have a noise, of bells made (in cases like Ægrotus's) of silver, or some other precious metal. By such arrangement our friends, the thieves, would have less intelligible notice of the approach of their enemies, in consequence of the musical mingling of the watchmen's bells in the distance; many deaths of worthy watchmen would be avoided by the non-inhalation of noxious vapours in the night; a vast deal of the discord, which so justly offends your Correspondent, abolished, and many pleasing castles left standing a little longer in the air, which are now avalanched to the ground by wretches having a parochial privilege to set dogs a howling, and render those to the sick list who were ceasing to belong to that list. Gracious heaven! what numbers must have been hurried to the grave, unpitied and unknown, by the practice which Ægrotus so strenuously recommends. He must surely be an undertaker,

I am, Sir, yours, &c.

Feb. 19th, 1826. W. W.

SIR,—A man beginning to repeat the hours till twelve,* as your Correspondent Ægrotus describes, would be half way down a short street, or turned the corner into another street, before he had finished. If Ægrotus wants to know the best way of ascertaining the hour from the watchman, he must get done what I have done in my own parish—direct the man to call "past ten;" *o'clock* is quite unnecessary, and is the reason why you do not hear the hour distinctly named.

I am, Sir,

Your obedient servant,

Feb. 20th, 1826. W. R. G.

* We rather think Ægrotus did not intend that his plan should be acted on till *after* twelve.—EDIT.

CHEAP PENDULUM.

SIR,—Although there are very excellent Pendulums invented, perhaps as good as might be wished for, yet the expense of them is a serious impediment to their being brought into general use; and, unless some other invention be substituted to supersede the enormous charge of gridiron or mercurial pendulums, in vain may we expect good time from either church or any other clocks that are made. I believe both the new and old church clocks are manufactured as well as need to be, and are also timed as well as can be before they are fixed in their proper situations, but the difference of time from five to twelve minutes in the various church clocks which I have noticed by a very excellent chronometer, proves what I have observed to be correct. There is, however, a newly-invented pendulum, which I am fully convinced possesses every property requisite for producing the most accurate time, and at an increased price not worth naming, and there can be no doubt but the inventor will reap the benefit of so important a discovery, by commanding at least the trade of the most respectable dealers in the article of clocks.

As it would be disingenuous in me to particularise the construction of the pendulum on the present occasion, I beg to defer a more enlarged account of it till I am satisfied the inventor is secured by a patent from any infringement.

Should the above meet with no objection to a place in your interesting Magazine, your insertion of it will oblige

Your obedient servant,

S— T—.

London, February 27th, 1826.

AN ADVANTAGEOUS PROCESS FOR SEPARATING GOLD AND SILVER FROM COPPER, EITHER WHEN IN ALLOYS, OR UNITED WITH IT BY PLATING.

(*From the Repertory of Patent Inventions, &c.*)

By treating the clippings or other waste of copper, which has been plated with gold or silver, with muriatic acid, or with a liquor composed of muriate of soda and sulphuric acid diluted with water, or with any other mixture capable of producing an action between the copper and muriatic acid; by accelerating this action; by preventing, at the same time, the muriated oxide of copper from mixing with the gold and silver that is separated; by simply decanting the liquor when it is in the state of brown muriate of copper well saturated, and when the formation of the muriated oxide is approaching; by treating the undissolved metal with a new quantity of the dissolving liquor, and in the same manner, to complete the solution of the copper, without forming the muriated oxide; finally, by fusing the metals which remain unattached with substances capable of depriving them of the small quantity of muriatic acid or muriate which may adhere to them, the gold and silver may be obtained the same as they were, and without any loss.

The application of this method may be extended to the inferior alloys; the only difficulty is to give to the metal the extent of surface which the nature of the action between the muriatic acid and the copper requires.

CULTIVATION OF THE WHITE POPPY FOR OPIUM.

SIR,—I shall feel very greatly obliged to any of your numerous Correspondents who will be kind enough to give me any information respecting the cultivation of the white poppy (*papaver somniferum*), for the purpose of obtaining opium. Success, I believe, has attended some of the efforts which have been made towards accomplishing this desirable object, and the result has been the production of very pure opium, equal in strength and much inferior in price to that which is imported from Turkey at a very exorbitant charge.

Any hint respecting the nature of the soil most suitable, the time of planting, distance between plants, and method of collecting the juice, will prove very acceptable.

I am, Sir,
Your most obedient servant,
PHILO-BOTANICUS.

P.S. Why is sound heard so much more distinctly in the night than in the day?

METHOD OF BROWNING IRON.

BY MR. J. DUNTZE,
Of Newhaven, United States.

Nitric acid	½ ounce.
Sweet spirits of nitre . .	½ ditto.
Spirits of wine	1 ditto.
Blue vitriol	2 ditto.
Tincture of steel . . .	1 ditto.

These ingredients are to be mixed, the vitriol having been previously dissolved in a sufficient quantity of water to make, with the other ingredients, one quart of mixture. Previously to commencing the operation of browning a gun-barrel, it is necessary that it be well cleaned from all greasiness and other impurities, and that a plug of wood be put into the muzzle, and the vent well stopped. The mixture is then to be applied with a clean sponge or rag, taking care that every part of the barrel be covered with the mixture, which must then be exposed to the air for twenty-four hours, after which exposure the barrel must be rubbed with a hard brush, to remove the oxide from the surface.

This operation must be performed a second and a third time (if requisite), by which the barrel will be made of a perfectly brown colour. It must then be carefully brushed

and wiped, and immersed in boiling water, in which a quantity of alkaline matter has been put, in order that the action of the acid upon the barrel may be destroyed, and the impregnation of the water by the acid neutralized.

The barrel, when taken from the water, must, after being rendered perfectly dry, be rubbed smooth with a burnisher of hard wood, and then heated to about the temperature of boiling water; it then will be ready to receive a varnish made of the following materials:—

Spirits of wine, one quart,

Dragon's blood, pulverized, three drams,

Shell lac, bruised, one ounce;

and after the varnish is perfectly dry upon the barrel, it must be rubbed with the burnisher to give it a smooth and glossy appearance.

NEW PATENTS.

To Robert Rigg, of Bowstead Hill, Cumberland; for a new condensing apparatus, to be used with the apparatus now in use for making vinegar. Dated 4th February.—Six months to enrol specification.

To J. C. Gamble, of Liffeybank, in the county of Dublin, chemist; for his apparatus for the concentration and chrystallization of aluminous and other saline and crystallizable solutions, part of which may be applied to the purposes of evaporation, distillation, inspissation, and to the generation of steam. 7th February. Four months.

To William Mayhew, of Union-street, Southwark, and William White, of Cheapside; for their improvement in the manufacture of hats. 7th February.—Six months.

To Hugh Evans, Harbour-Master, of Holyhead; for his method of rendering vessels, whether sailing or propelled by steam, more safe in cases of danger by leakage, &c. 7th Feb.—Two months.

To William Chapman, of Newcastle-on-Tyne; for his improved machinery for loading or unloading of ships. 7th February.—Two months.

To Benjamin Cook, of Birmingham, brass-founder; for improvements in making files. 7th Feb.—Six months.

To William Warren, of Crown-court, Finsbury-square; for improvements (communicated from abroad) in the process of extracting from the Peruvian bark quinine and cinchonine, and preparing the various salts to which these substances may serve as a basis. 11th February.—Six months.

To John Lane Higgins, of Oxford-street; for improvements in the construction of the masts, yards, sails, rigging of ships, and in the tackle used for navigating the same. 11th February.—Six months.

To Benjamin Newmarch, of Cheltenham, and Charles Bonner, of Gloucester; for their invention for suspending and securing windows, gates, doors, shutters, blinds, and other apparatus. 18th February.—Six months.

To Thomas Walter, of Luton, Bedfordshire; for improvements in straw plats, for making hats, &c. 18th February.—Six months.

To Charles Whitlaw, of Bayswater Terrace, Paddington; for his improvement in administering medicines by the agency of steam. 18th Feb.—Six months.

To Arnold Buffum (late of Massachusetts, but now of Bridge-street, London); for improvements (in part communicated from abroad) in making and dyeing hats. 18th Feb.—Six months.

NOTICES TO CORRESPONDENTS.

The Series of Papers offered by our esteemed Correspondent, T. M. B., will be very acceptable. We risk nothing in leaving the point of selection to his own judgment.

The improvement suggested by "Amicus," and one or two others, which we have ourselves had in contemplation, will shortly be carried into effect.

Communications are received from—A. F.—R. R.—G. C. J.—Gasometer—J. Spiers—N. M.—A Learner—Anvil—Peep Bo—One of the Committee—And Milo.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by MILLS, JOWETT, and MILLS (late BENSLEY,) Bolt-court, Fleet-street.

Mechanics' Magazine,

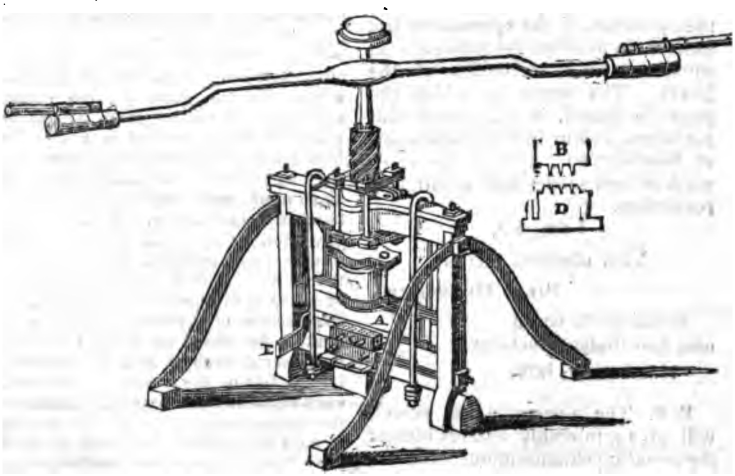
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 134.] SATURDAY, MARCH 18, 1826. [Price 3*d*.

" Think deeply, then, O man ! how *great* thou art ;
Pay thyself homage with a *trembling* heart.
* * * * *
* * * * *
Enter the sacred temple of thy breast,
And gaze, and wander there a ravish'd guest ;
Gaze on the hidden treasures thou shalt find,
Wander through all the glories of thy mind :
Of perfect knowledge, see the dawning light
Foretells a noon most exquisitely bright."

Young.

PUNCHING MACHINE.



PUNCHING MACHINE.

Sir,—I beg leave to submit for insertion in your valuable and interesting publication, a sketch of a Punching Machine, invented by my father, by which we are enabled, in preparing kiln-plates for maltsters, to punch upwards of 2000 holes in a minute, and thereby to avoid the tedious process of the hand-punch, by which kiln-plate work was formerly done; the work is also much more uniform and neat than the most experienced hand could turn out by the old mode, as the dies or punches, 255 in number in our machine, being set at exact distances into the bolster, A (under side shown at B), the operator has but to take a little time in getting his work correct for the first series of holes, as the burs of these, meeting with resistance at the ledge of the plate C containing the holes to receive the dies (transverse section at D), furnish the operator with a correct guide for the second series of holes, and those of the second for the third series, and so on, as fast as the men can work the levers. We have also, as a further corrective, a piece of iron bar (E) projecting at right angles with the bolster, &c. which prevents even the possibility of a slip to the right or left in the course of the operation, if the operator be but uniform in pushing the kiln-plate in square at each oscillation of the levers. The screw by which the power is gained, in connection with the levers, is four inches in diameter, of four threads, and of the steep pitch of four inches and a half to a revolution.

I am, Sir,

Your obedient servant,

Silas Glaysher.

Strand on the Green,
near Kew Bridge, Middlesex,
10th January, 1826.

P. S. The accompanying sketch will give a tolerably correct idea of the *actual* appearance of our machine; but it would be easy, in constructing a new one, to introduce into it very considerable improvements: there could be, for instance, four levers instead of merely two, by which a greater power would be gained, so as to admit of an increased number of dies, and, of course, greater despatch in the work obtained.

REMARKS ON MR. BEVAN'S SOLUTION OF TRIGON'S QUESTION.

Sir,—Referring to the solution of the question by Trigon, at page 140, No. 121, vol. v. of the Mechanics' Magazine, Mr. Bevan says,—"If these globes were placed in close contact on a plane, they would fill a circle of nearly ten millions of miles in diameter." Now, Mr. Bevan will please to excuse me for considering him rather faulty in withholding the method of determining this diameter. The following solution I have had by me several weeks, which, if you deem it worthy of a place in your very valuable miscellany, its insertion will oblige, Sir,

Your most obedient servant,

Joseph Hall.

Harpurhey.

We are told by astronomers that the sun's diameter is 100 times as long as the earth's, and spheres being to one another as the cubes of their diameters, therefore the magnitude or bulk of the sun is 1,000,000 times that of the earth. By the question, the globes equal in size to the earth are to be placed in close contact in a circular form; being thus situated, it is evident they will occupy the same plane area as so many great circles of the sphere touching each other. We can place any number of equal circles (which number must be equal to the sum of the series 1, 2, 3, 4, &c.) in the form of a trigon or equilateral triangle. If the centres of three equal circles in contact be joined by right lines, an equilateral triangle will be formed; let any two of the sides be prolonged, each equal to three times the radius of the circle; now let circles be formed in contact as before, and then we shall have three circles whose centres are in the same straight line; prolong the sides the same as before, and describe

circles, and then we shall have four circles whose centres are in the same straight line; the number of circles in the whole will be $1 + 2 + 3 + 4$, &c. $= 10$, &c. Now it is evident that six times the number of circles forming one equilateral triangle together, with six times the number of circles formed in contact on the radius of the required circle, will complete the whole circle whose radius is required.

Let x represent the number of circles formed in contact on the radius of the required circle, then will $6x - 5$ be the number of circles formed on six radii. The number of circles contained in one equilateral triangle is $\overline{x - 2 + 1} \times \frac{x-2}{2} = x^2 - 3x + 2 \times 6 =$ $3x^2 - 9x + 6 + 6x - 5 = 1000000$. This quadratic equation, solved according to the rules of Algebra, we find $x = 577.85$ minus $1 = 576.85$. Let the earth's diameter be 8000 miles, $576.85 \times 8000 = 4614800$ miles, the radius of the required circle, the circumference of which would pass through the centres of only six of the outer circles in contact had x come out a whole number; and, if the centres of these six circles were joined by straight lines, an hexagon would evidently be formed.

MR. BADNALL'S PATENT SILK MACHINERY.

SIR,—In answer to your Correspondent, Mr. H. Jones, page 279, No. 130, of your valuable work, I beg to refer him to a statement made by me in the Stockport Advertiser, of a recent date, in answer to a similar assertion.

I can only affirm, as I have before done, that Mr. Badnall is the patentee and inventor of the machinery alluded to, and that I am the sole manager and manufacturer of the whole of his patent machinery, and therefore deeply interested in its success.

I have only further to add, that the assistance I have given, and shall continue to give, in the manufacture of this valuable machinery, has been only such as I have hitherto and ever will continue to give in every instance as far as my humble abilities enable me, and particularly in a case like the present, where the utmost confidence has been invariably placed in me.

What Mr. Abbott has stated respecting the inventor or the invention of the machine alluded to, I have never seen, therefore I cannot answer or comment upon it.

Hoping this will be a sufficient answer for Mr. Jones, and that I shall not again be troubled on this subject,

I remain, Sir,

Your obedient servant,

G. SCOTT.

Leek, March 1st, 1826.

LEARNING MORE TRADES THAN ONE.

SIR,—Having read in your invaluable Magazine a paper signed H. B. T., in which the writer attempts to show the propriety of learning more trades than one, and thinking not only that he has failed in so doing, but that his arguments do not at all bear upon the point he has set up, you will very much oblige me by inserting the following observations:

He has shewn the *advantages* but not the *propriety* of knowing more than one branch of industry. A thing may in itself be desirable, but yet not proper to be attempted, and for the best of all reasons—because it may be unattainable. The time occupied in endeavouring to put into execution an impracticable object, must, of course, be time thrown away. But to come to the point at once—allow me to suppose the case of a lad, of a proper age to be apprenticed to some trade, being allowed to choose that which he likes best, he will fix, perhaps, upon that of a carpenter, when some kind friend (like H. B. T.) will represent to him how much it would be to his advantage to be also a blacksmith and a bricklayer, because, if he happen at any time to be out of work as a carpenter, he can turn to the trade either of smith or bricklayer. The lad, no doubt, seeing how much his knowing three trades, instead of one, would be *to his advantage* (without consi-

dering the practicability or propriety of the plan), will determine to learn all three. But how, I ask, would or *could* he set about it? Could he, with any thing like propriety, divide his day into three portions of time, one to be employed in the carpenter's shop, one in the blacksmith's, and one in learning how to lay bricks? and with any thing like a prospect of his becoming *master* of one of the trades, much less of the three? I think not: and I think it would be equally impossible for him one year to be one of the trades, and one year another, each taking its turn. What he learnt of the trade of a carpenter in the first year, would be almost if not entirely forgotten during his studies in the blacksmith's shop, and so with regard to the other trade. Divide his time how he would, I am sure it would be impossible to learn three trades at once. Again, even supposing half the term of his apprenticeship to be sufficient to teach him to do 'journeywork' as a carpenter, he must continue to practise as such (else he would forget the craft), which he could not do if, at that period, he were to commence smithing, and continue it for the other half of his term; so that, when his term was ended, he would leave off just where he began, excepting that he would cease to be a carpenter, and would be only a blacksmith instead. He would still only know one trade, and he would be worse off than if he had stuck to the trade of a carpenter, as, in that case, he would have been master of it by the time that he knew only *part* of two trades—thus, he would be "Jack of the two, and master of neither."

Having thus, I think, shown the impracticability of what H. B. T. proposes, and consequently its impropriety, I shall conclude by most cordially agreeing with him in what he says with regard to the benefits you have conferred upon the mechanics of the whole empire by your praiseworthy and enlightened efforts, the success of which, I think, is amply shown by the conduct of the suffering silk-weavers of Spitalfields. The cause of this behaviour lies, I think, first, in your Magazine; and, secondly, in the establishment of Mechanics' Institutes (of which your work was the main spring), and the general spread of knowledge.

I remain, Sir,
Your obliged servant,
AURUM.

RAILWAY EXPERIMENTS.

The following proposal is in circulation for the establishment, at Edinburgh, of an association for making experiments respecting Railways. Its objects are so purely patriotic, that every person must wish it success:

"During the last ten years, Railways have occupied much of the public attention. The Highland Society of Scotland has recently suggested for consideration the points in which the system, as hitherto practised for local purposes and private objects, is defective or inapplicable, on a great scale, to the national object of establishing a general and improved system of land carriage. On private railways the load commonly goes one way only, and on a descending line; but for general carriage, and alternate trade, the load must go both up and down. Speculation, practical and theoretical, has been keenly excited; yet truth and error still remain mingled in the public mind, and it is of great importance to separate them, by affording an opportunity of bringing to trial many new and highly interesting views lately brought forward on the subject. If a course of experiments prove these views to be unsound, it will be wise to pause; if, on the contrary, it is found possible to surmount the difficulties which present themselves to the establishment of general railways, it cannot be doubted that they will add incalculably to the resources of Great Britain.

"To an associated body the expense of such experiments will be an inconsiderable object. The rent of the ground occupied, a few hundred yards of railway, an inclined plane, a competent number of waggons, a locomotive engine, and a

weighing machine, with the services of fit persons to conduct the experiments, will form the leading parts of the expense. Every individual experimenting separately must incur such expense, but when once incurred, in the case of an Association, it will suffice for the public at large. An institution, therefore, affording facilities to ingenious men, without distinction of class or nation, to ascertain facts connected with the use of steam and animal power on railways, and to bring to trial, at a small expense, new inventions or improvements, must be highly desirable. The experiments will be made under the eye of men the most celebrated for scientific and practical skill. It is in particular proposed to request the assistance of the Professors of Natural Philosophy and Mathematics, the Members of the Royal Societies, of the Societies of Arts, and of the Schools of Arts in every part of the kingdom. The Association will also be happy to avail themselves of the aid of engineers, and of all other individuals eminent for mechanical science, and particularly of engineers connected with or employed upon the railways now in progress or in contemplation. The experiments, so conducted, will be duly recorded, and the details and results published and circulated to the subscribers, which will serve either as a guide or as a warning to future inquirers.

"With these views, an Association, to be named 'The Edinburgh Association for Railway Experiments,' is now proposed to be formed.

"To render the experiments an object of general interest, and that the Association may comprise as great a variety of talent as possible, no subscription is to exceed *three guineas*, and may be any smaller sum. But this limitation does not apply to public bodies, railway companies, and iron-masters, who may contribute to any amount which they may deem suited to their interest in the objects sought to be attained.

"Donations will be accepted of machinery, implements, railway bars, &c. &c., or they may be received on loan, at a rent to be paid during the period the machinery is employed."

The interim Secretary of the Institution is Cladius Shaw, Esq., Civil Engineer, late of the Royal Artillery, 16, Elder-street, Edinburgh; and the Treasurers are Messrs. Gibson and Oliphant, W.S., Edinburgh.

WATER-COLOURS.

SIR—Through the medium of your interesting Magazine, I beg to inquire the best method of painting with water-colours on glass?

I am, Sir,
Yours respectfully,
M. DE C.

MR. ORCHARD'S PLAN OF A VACUUM ENGINE.

[To the Editor of the Mechanics' Magazine.]

SIR,—The intention of this engine seems to be an attempt to cheat a syphon out of its principles. In the first place, Mr. Jas. Orchard directs a portion of mercury contained in the space 1, 2, 3, 4, of the small vessel, E, to be let run out; and I take it for granted he intends to have a vacuum in the place of it, but he has forgot that the mercury will not run unless he admits the atmosphere to the top of the vessel; the same will be the case with the other vessel, provided we could get rid of that in the small vessel. He then says, the air, pressing on the pipe, A, will force the mercury out of the large vessel, B, into the small one, and leave a vacuum in the place of it, which is most certainly impossible.

If I should be mistaken in my ideas, I shall feel thankful to any one who will correct me.

I am, Sir,
Your obedient servant,
HAASPE.

RESULTS OF A METEOROLOGICAL JOURNAL, FOR FEBRUARY, 1826.

Kept at the Observatory of the Royal Academy, Gosport, Hants,

BY DR. BURNEY.

		Inches.		
Barometer	Highest	30.44,	February 26th	—Wind S.W.
	Lowest	29.33,	17th	S.

Range of the Mercury.............. 1.11.

	Inches.
Mean Barometrical Pressure for the Month	29.957
—— for the Lunar period, ending the 7th inst.	30.006
—— for 15 days, with the Moon in North declination	30.218
—— for 15 days, with the Moon in South declination	29.794
Spaces described by the rising and falling of the Mercury	6.000
Greatest variation in 24 hours	0.680
Number of changes	26

Thermometer	Highest	56°,	February 25th and 28th.
	Lowest	33	9th, Wind E.

Range	23
Mean temperature of the external air	45.91
—— for 30 days, with the Sun in Aquarius	43.23
Greatest variation in 24 hours	16.00
Mean temperature of spring water at 8 A.M.	49.44

DE LUC'S WHALEBONE HYGROMETER.

	Degrees.
Greatest humidity of the Air	96 in the morning of the 6th.
Greatest dryness of ditto	63 in the afternoons of the 7th & 25th.
Range of the Index	33
Mean at 2 o'clock P.M.	75.8
—— 8 o'clock A.M.	84.4
—— 8 o'clock P.M.	84.2
Mean of three observations each day, at 8, 2, and 8 o'clock	81.5

Evaporation for the Month	1.30 inches
Rain in the Pluviameter near the ground	3.86
Rain in ditto 23 feet high	3.42
Prevailing Winds, S.W.	

A SUMMARY OF THE WEATHER.

A clear sky, 3; fine, with various modifications of clouds, 11; an overcast sky, without rain, 6; foggy, ½; rain, 7½.—Total, 28 days.

CLOUDS.

Cirrus,	Cirrocumulus,	Cirrostratus,	Stratus,	Cumulus,	Cumulostratus,	Nimbus.
18	9	27	0	17	18	21

A SCALE OF THE PREVAILING WINDS.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Days.
0	0	2	4	5½	10½	4	2	28

This month has been mild for the season, but generally windy and wet, agreeing with the old proverb, "February fill dike." It has rained, more or less, on 20 days; and the thermometer, a few feet from the ground, has not receded once to the freezing point. In consequence of the constant humid air, very little evaporation, and the quantity of rain, the ground has been saturated nearly the whole month, and is now in good condition for an early produce of the approaching Spring.

The average temperature of the external air this month is $2\frac{1}{4}$ degrees higher than in February 1825, and nearly $3\frac{3}{4}$ degrees higher than the average of that month for the last ten years. There is a difference in the mean temperature between last month and this of $10\frac{1}{4}$ degrees!

The temperature of spring water has increased upwards of one degree this month, and is $1\frac{1}{4}$ degree higher than at this time last year. This is certainly an unusual circumstance in February, as the temperature of spring water almost invariably decreases till the vernal equinox, and sometimes later. The last two or three days having been dry, and the temperature of the ground increasing, there was a sudden appearance of the fruit, and other trees, breaking into bud.

Although the wind has prevailed half the month from S.W. and West, yet the result of the barometer is above the general mean indication, arising, no doubt, from the closer union of the atmospherical particles, and a lower temperature in the superior stratum of air not far above the disturbing force of the late S.W. gales of wind.

The atmospheric and meteoric *phenomena* that have come within our observations this month, are one parhelion, one solar and one lunar halo, three meteors, and eight gales of wind or days on which they have prevailed, namely, one from S.E. and seven from the S.W.

CONCISE METHOD OF CORRECTING THE DEAD RECKONING AT SEA, BY LOGARITHMS.

RULE.

Add together the sum or difference of the departures, viz. either Eastings or Westings, made during the time of the required connection, omitting to take into the account the departure made on the day the first observation was taken; then, as radius is to the sum or difference of the departures, so is secant of middle latitude to the difference of longitude.

EXAMPLE.

Being at sea on the 8th of November, 1825, in latitude, by observation, 43° 15′ N., longitude 35° 23′ W., have since made the following departures or Westings, viz. on the 9th, 76 miles, 10th, 84m., 11th, 93m., 12th, 63m., on which day our latitude, by observation, is 34° 52′ N. Required the longitude in.

Departure on the 9th....76
10th....84
11th....93
12th....63

Sum of departures.......136

Latitude, Nov. 8th.........43° 15′ N.
12th.........34 52 N.

2)78 07

Middle latitude 39 03

Radius 10.00000
Sum of departures, 316 log.. 2.49969
Middle lat. 39.03 sec.........10.10980

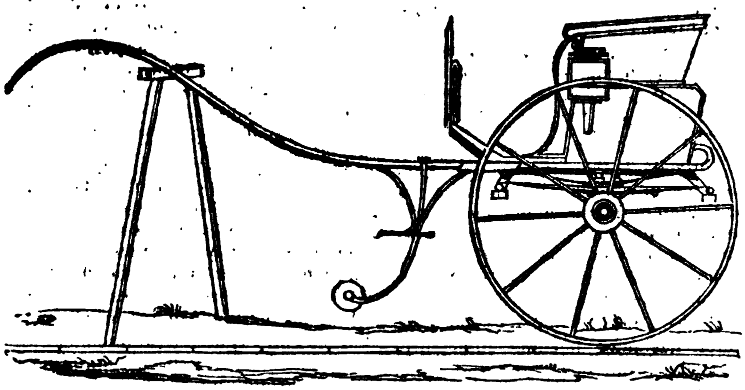
Difference of long. 407m..... 2.60949

Longitude in on the 8th..35° 23′ W.
Difference of long. 407m.=6 47 W.

Longitude in on the 12th..42 10 W, by dead reckoning.

I am, Sir,
Your obedient servant,
T.... O....

SAFETY-GIG.



SIR,—Having read in a late Number, further particulars of Mr. Matthews's improved Gig, and having also seen the carriage itself, which, in my opinion, falls far short of the great object to be attained, namely, safety with improvement, I beg to enclose you a sketch of a simple invention of my own, which I have used for some months, and am every day better satisfied with its advantages, as it combines safety with neatness.

I remain, Sir,
Your obedient servant,
J— B—.

EXPANSIVE FORCE OF STEAM.

SIR,—I beg the attention of your readers to a communication from W. G., in No. 61, page 78, on the "Expansive Force of Steam." Like him, I have seen the table alluded to in many publications besides the one he mentions; among the rest, in Nicholson's Mechanic, Brunton's Compendium, and Mortimer's Dictionary of Commerce. Like W. G., I am willing to believe the "statement drawn by an intermediate hand," and shall hold myself indebted to any of your Correspondents who will inform me where I can find an account of the manner in which Mr. Woolfe made his experiments, or his own description of the results obtained from them.

I remain, Sir,
Your obedient servant,
S— Y—,
A Young Engineer.

THE CHINESE MODE OF HEATING HOUSES AND APARTMENTS.

(Concluded from page 308.)

"These stones or paving-tiles resting on blocks of stone or bricks, may be made of any thickness required for the extent of the air-flues which are employed.

"It must be obvious, from inspection, that this mode of disseminating heat will be more economical even than the plan of the Russian stoves, whilst it disperses the heat more uniformly over the apartment, by its coming in contact with every part of the floor. These floors also being built of very imperfect or slow conductors of heat, and, in the better class of houses, the paving-tiles being made of ornamental porcelain ware, of considerable thickness, when the floor has once become sufficiently heated by the flues, and the apertures of the main flues at the exterior being stopped, these porcelain floors will retain a sufficient heat for domestic comfort for many hours, or rather during the remainder of the day.

"It is, perhaps, good economy in such cases not to let the temperature get below a certain point before a fresh portion of fuel is added to the fire; on the same principle as that it is a wasteful practice to allow the air furnaces of founderies, or other manufactories, to become extinct.*

"The only objection that seems to present itself against the Chinese method of heating rooms, is that of the flues becoming choaked by the deposit of soot. This evil is, however, in a great measure avoided by the close economy of this ingenious people. For, instead of employing pit-coal of good quality, they make use of the inferior or small coal for this purpose, which refuse coal is mixed with a compost of clay, earth, cow-dung, or any refuse vegetable or carbonaceous matter, and then formed into balls, which are dried in the sun or open air. Independent of the cheapness of these fire-lumps or balls, they give out very little smoke during combustion, and consequently the flues are proportionably less liable to be choaked with soot. In some cases wood is employed for domestic fuel in China; but as they possess abundance of coal, and have a general communication throughout the kingdom, by water carriage, coal, or composts of coal and earth of various kinds, constitute the bulk of the fuel used in that country.

"In the inferior class of houses, instead of having the stove built outside the house, it is constructed in a corner of the ordinary room. A pit being dug for the body of the fire-chamber and draught-hole, and the top or head of the stove is used for the different operations of cooking, or other domestic purposes.

"That no portion of heat may be lost, or escape into the room by radiation beyond what is requisite to maintain a given temperature, the Chinese place vessels of water on the head of the stove; which serves both to absorb and economise that heat which would be, otherwise, lost or waste; while it affords the necessary supply of moisture by evaporation, to preserve the atmosphere of a room always in a state of salubrity or of comfort. In this instance, therefore (as well as many others in the useful arts), the English might take a lesson from these ingenious people; for a great portion of the inconvenience and oppression which we feel in our apartments during the summer season, or even in winter, when a considerable number of persons

---

* It appears, from the ruins of the Roman villas which have been discovered in England, and particularly from that described by Mr. John Lyster, in the Philosophical Transactions for 1706, vol. xxv. page 2226, that these flued floors constituted that kind of hypo-caustum which the Romans called fornax, or cœnatiuncula hybernaria, except that the fire-room and chamber, or flue, was confounded into one, a deeper space being left between the two floors of tiles and the space heated by burning wood on the lower floor, the fuel being introduced by a door on the side. The ravages of the northern nations seems to have occasioned the disuse, in this country, of the Roman mode of heating rooms, and to have introduced our present ruder manner of effecting the same object.

assemble together in rooms, artificially lighted, arises from the want of sufficient humidity in the air for the purposes of animal respiration.

"We have already shewn in a previous chapter, that a few open or shallow vessels of water placed in crowded apartments, such as assembly-rooms, lecture-rooms, &c. would have a beneficial agency as an absorbent of part of the vitiated air (ammoniacal gas); but it is perhaps of far greater importance to health, to afford at all times an adequate supply of moisture to the air.

"Although a very humid atmosphere —especially when accompanied by a low temperature, as during our autumnal months—is disagreeable, and productive of chronic diseases, as well as "low spirits," yet the consequences of an excess of moisture in the air, are not so injurious to health as a deficiency of moisture.

"Were it not for this important agency of water—designed by our beneficent Creator as the regulator of so many natural phenomena—we should not be capable of withstanding the scorching rays of the sun in tropical latitudes, nor the severity of the northern blast of winter. For, in the former case, the evaporation of water following the elevation of temperature of the air, and (as we have previously shewn) the conversion of water into vapour requiring a prodigious supply of caloric from the air—whilst a sufficient supply of water exists, the absortion of heat by the process of evaporation, will always keep the temperature of the atmosphere below that of the human body, or 96° Fahrenheit. But in the interior of a large continent, or in districts abounding with vast deserts or sandy plains, the want of humidity in the air sometimes allows the thermometer to range from 110 to 120 degrees, in the shade.

"Another proof of this beautiful agency of water, in moderating the extremes of temperature, is equally apparent in high latitudes. The cold currents of wind blowing from the north and north-east during the winter, in our hemisphere, would be perfectly insupportable, if they were not mitigated in their severity by the aqueous vapour existing in our atmosphere. For during the process of congelation the aqueous vapour not only gives out to the atmosphere the vast quantities of caloric (estimated at 900° Fahrenheit) which is held in combination under the gaseous form; but about 140 degrees additional, while passing from the liquid (water) to the solid form of ice or snow.

"It thus appears, notwithstanding our dislike or apprehension of the severity of snow-storms, that they are destined to answer a most important purpose in the economy of nature, by moderating the inclemency of the climate in high latitudes.

"The importance of water, or rather of aqueous matter, in the grand external magazine called the atmosphere, will thus enable us to form an opinion of its value as a regulator in our domestic edifices. As each cubic foot of air (according to the accurate calculations of Mr. Daniell, in his valuable Meteorological Essays) at the temperature of 60° contains about 6.2 grains of water, when saturated with moisture; it will be readily seen, that a considerable supply of this aqueous matter will be necessary to maintain the air in a respirable state, whenever the temperature is much increased, and the air of the room become dried and vitiated by artificial lights and fires. The capacity of air for moisture being proportionate to the temperature, in an increasing ratio—a cubic foot of air at the temperature of 84° will require 12.7 grains, or more than double the quantity of water necessary to saturate air at the heat of 60 degrees."

NAVAL ARCHITECTURE.

(*Concluded from page* 304, *No.* 131.)

Sir,—I have seen lately many observations on what is called the imperfect method of casting tonnage. In this our forefathers had correcter ideas than many in this day are willing to allow. Their method of cast-

ing tonnage formed rules for building, which are consistent with reason and sound sense; it is only avarice, and the love of gain, that have caused innovation. No general rules can be more correct; and were vessels constructed to carry the register tonnage only, we should have perfect models, with every qualification of sailing and safety; shipwrecks would scarcely be heard of, or the loss of so many valuable lives. It is the deviation from those principles that is the cause, generally, of such scenes of horror and distress. For the safety of life and security of property, it would be well for the country were Government to lengthen the arm of power, and make it a law, that no vessel should carry more than her register tonnage. No. 1, of your Correspondent P. N.'s sections, is the form which all scientific men have considered of the greatest stability, and could vessels so constructed be always kept on an even keel, it is that form which would meet the least resistance, but under a great press of sail her change of position reduces her qualifications. No. 2 is that form of body, with little alterations, I should choose for my midship section for a fast-sailing vessel, because there is a capacity to work on for a fine entrance and easy delivery. I pass over No. 3 and 4, having little or no interest. No. 5, is that form which appears to be the favourite design of P. N., who says that a hollow garboard is proverbially stiff; from which he concludes, that it must be doubly advantageous to carry the hollow to the line of floatation. Now, without saying much on the small displacement, and, of course, the small quantity of ballast such a body would require—and without ballast sails would be useless—I would ask, what sort of entry or delivery such a body would make? One essential point in the construction of a vessel is, that the displacement, at every section, should be equal to its own weight, to prevent a reaction in midships; that is, if the two extremes are so sharp that the parts above water are unsupported, the vessel swims on a pivot. The unnatural action this will produce must retard her passage through the water; her fineness then becomes an evil. It is true, a hollow bottom adds to the stability of all floating bodies; but extremes should be avoided, lest your body should in any part lose her equilibration. If by a raking stern is meant that part out of water, little or no advantage can be derived from it as to velocity, but it is a great advantage in a single-masted vessel, by carrying her main sheet farther aft, which trims the sails nearer the wind, which is commonly termed "flatter aft." It adds room on deck, and gives space below to stow dry goods; but the most essential advantage, according to my observations, will consist in the rake of the post. A raking-post is good in many respects. First, it shortens the keel for tonnage; secondly, it throws the action of the rudder near the centre of gravity, which makes her quick at the helm, and easy to steer. It likewise gives the action of the rudder under the point of pressure on the main-sail, which increases the velocity; it also augments the breadth of the rudder without friction; and lastly, the advantage of a raking stern is, that the point of the water's action on the rudder becomes the pivot whereon the vessel, as a wheel, revolves; the part which is the aft side of the pivot balances the body, and adds velocity, by which the vessel comes round quick on her keel. If a vessel is built with an upright post, her midship section should be further aft, otherwise her equilibrium will be lost, and with it her stability. I knew a smack, built some time since, with her post square from her keel; she laboured much in a sea, frequently missed stays, was very crank, and altogether an unruly vessel, so much so, that the owners were at a loss what to do with her. I advised them to cut off her keel, and give her the usual rake; they accordingly cut off six feet of her keel; she now answers as well as most vessels of her class. A deep keel to a flat vessel is an advantage, by making her more windwardly; but this may

likewise be carried to extremes—beyond fifteen inches is of no advantage: but to a sharp vessel a deep keel is of little use, because it increases the resistance without adding to her capacity. As to an iron false keel, it is all theory without judgment. It is true, it acts as ballast, but like water, it is of the worst kind. Place your vessel on a wind, under a press of canvass, and the man at the helm is obliged to keep her shaking. When she goes too near, she immediately springs upright, and looses her velocity; she again pays off and fills, but before she gets way she is down on her beam-ends, where she is stationary, and in danger. The iron keel acts as a pendulum, but adds nothing to her stability. It is only single-masted vessels that immediately require to be trimmed by the stern, to counteract the foresail, which would otherwise overpress her.

My letter has extended beyond my first intentions; I shall conclude, therefore, by a few remarks on the foregoing observations.

The stability of a vessel, and, of course, her sailing, depends on her greatest expansion on the line of floatation. The best place for the ballast is on a level with this line. The velocity depends in a great measure on the proper station of your mast. All lean vessels forward require the mast well aft; the reverse if full. It is a mistaken notion, to suppose that a vessel's ballast ought to be down low in the bottom. What makes a vessel stiff and steady, is, when a part of your ballast to windward is above the water; it then becomes a lever to counteract the pressure of the sails. Your ballast, in all cases, ought to be up as high as possible. Look at rowing-boats under canvass—gigs and galleys, without ballast, with seven or thirteen men. Look at men-of-war's double bank cutters, with fourteen, and sometimes twenty men or more, all in their stations, with more canvass set than any vessel of their displacement. Where is their centre of gravity?—Wholly above the line of floatation; yet they lose nothing of their stability. Look at our men-of-war, our old three-deckers, with four tier of guns, &c.—has it not been proved that they are the stiffest and best sea-boats in the world? How often have vessels foundered with cargoes of iron placed solid in the hold; while those with the same weight and cargo, by raising it up to the line of floatation, have gone safe?

If these few remarks, which have been collected in haste, and almost without order, should contribute to any single individual a just way of thinking and applying his thoughts to advantage, I shall be satisfied.

I remain, Sir,
Your very humble servant,
NOAH.

SIR,—I have for some time been a silent observer of the party spirit and conflicting opinions which occasionally issue to the world, through the medium of your excellent periodical, and more particularly of late, on the subject of Naval Architecture. It must be regretted by the disinterested portion of your readers, that this noble art should be made subservient to such impolitic measures, and that any portion of your pages should be engrossed by matter so little calculated to do good.

Nothing is more delightful than to trace the progress of argument, when kept up with liberal feeling, and an evident desire to promote the subject under discussion; on the other hand, it is equally painful to witness two parties taking up cudgels against each other, under the semblance of being advocates in the cause of improvement, and descending to abuse, with all the acrimony of personal invective, thus degrading themselves, and weakening the common cause. I had hoped that the ventings of spleen and prejudice, which unfortunately crept into your columns some months ago, had subsided, and given place to moderation and honourable discussion, until the letter from "An Old Lieutenant," signed T. W., appeared in Number 126 of your Journal, to open the

wound afresh, and set the probe of a "Practitioner" at work, in your last Number.

Such remarks as these letters contain cannot benefit naval science in the least degree, but rather, by odious comparisons, tend to awaken prejudices, and kindle angry feelings between the parties concerned, thereby creating disunion in his Majesty's service, instead of promoting zeal and co-operation.

My occupation affords me the opportunity of communicating with the Dock-yard officers, and I believe I may say, on the part of those who have been students at Portsmouth, that they regard the "Old Lieutenant" as an enemy, rather than a friend, and would "feel more honoured in the breach than in the observance" of his fulsome comparisons.

I think, Sir, the question at issue may be very fairly stated, and an answer given, in accordance with the opinion of every one who has a grain of liberal feeling, or whose judgment is not too much warped and biassed by the overpowering prejudices of human nature.

When we daily hear of the vast improvements in the arts in general, by the aid of science, is it not worse than blind prejudice, to contend that ship-building is beyond the reach of its fostering hand? I shall be anticipated by every thinking being, when I reply, that naval architecture, above all other arts, from the wide field it opens for invention and improvement in all its branches, must derive incalculable advantage from scientific research. In this country, the *practical* part of ship-building stands unrivalled; but it must be acknowledged, that other nations have excelled us in the perfection of their models; and why? —because they have cultivated the art scientifically: and I need hardly add, that the introduction of science into our naval arsenals must ultimately be of advantage to the country, provided our young *aspirants* meet with liberal support, and are not discouraged by the spirit of opposition. The progress to improvement will, however, be greatly retarded, unless these growing feuds are checked, and opinions more conciliatory, and views more congenial to the minds of old experienced men resorted to, than those set forth by T. W., who cannot, I repeat, be a well-wisher of the establishment he pretends to uphold.

Permit me, Sir, to make a few remarks upon the import of your note at page 222, and which I. offer with the more satisfaction, as being the opinions of many of the gentlemen with whom I have conversed, holding high situations in our naval arsenals.

The young men from Portsmouth enter the Dock-yards under peculiar disadvantages, at a time when the change of system throws upon them a very heavy responsibility, and subjects them to a much more arduous duty, than former executive officers had to transact, in consequence of the abolition of that useful class of officers denominated Quartermen, whose station in the Dock-yards may with propriety be compared to that of Serjeants in the army—connecting links between the commanding officers and men—and as well might the Government dispense with the latter as the former. Formerly, too, I am told, when the young men who were destined to become officers had served their apprenticeship, and moved through the grades of promotion to the rank of foreman, each had his *nurse*,* his *factotum*, his *guide*, and *right-hand man*, to assist him, and regulate his duties. Now, the case is widely different; the foreman must trust to his own knowledge and abilities; yet I do not hear that there is any cause for complaint, or that the service does not go on as well now as heretofore.

I remain, Sir,

Your obedient servant,

VERAX.

London, Feb. 21, 1826.

---

* Generally an old experienced quarterman.

FEATS OF THE STICKLEBACK.

In vol. III. of the Edinburgh Journal of Science, p. 74, Mr. Ramage, of Aberdeen, has given an account of a Stickleback, which was taken alive with a leech "fully as large as the stickleback itself" in its intestines. The leech "in a few minutes" was protruded by the anal opening, and crawled on Mr. Ramage's hand; but "the stickleback died almost immediately after giving birth to the strange offspring, and the leech survived it only about twelve hours." The appearance and motion of the leech, it is added, "corresponded in every respect with those of the common leech, excepting that the colour was entirely white." The theory offered to account for this fact is, "that the leech was lodged in the small gut, and most probably had been swallowed by the stickleback for food when of a small size, and had grown to its present dimensions in the stickleback's belly, after having been swallowed." The leech and the stickleback were transmitted to the Museum of the Royal Society of Edinburgh.

On these singular facts, a Correspondent in the last number of the Annals of Philosophy makes the following remarks :—

"The circumstance of a stickleback swallowing a leech is no uncommon one, for young leeches seem to be the favourite food of the three-spined stickleback, *gasterosteus aculeatus*, *Lin.* My boys had several sticklebacks alive for some months during the last summer, and fed them at first with earth-worms, maggots, and occasionally the small house-fly, which, however, did not seem to be relished. Afterwards, at my suggestion, young leeches were brought from the ditch in which the sticklebacks were caught, as being more likely, with the larvæ of aquatic insects, to form part of their natural supply, than the food which was submitted to their choice. These were found to be preferred to all other aliment, and for a month at least they had scarcely any other food. The species of leeches procured were the *Hirudo sanguisuga*, the *H. vulgaris*, and the *H. complanata*. To ascertain what size of leech would be swallowed, a male stickleback, of about an inch and three-quarters in length, was selected, and put in a large tumbler on a mantle-piece, where its mode of attacking and devouring its prey formed a source of amusement to the children for weeks.

"On putting the leeches into the water, the stickleback darted round the tumbler with lively emotions, till it found a leech detached, and in a proper situation for being seized. When the leech was very small, say about half an inch in length, it was often swallowed at once before it reached the bottom of the vessel; but when a larger one, about an inch, or an inch and a half in length, in its expanded state, was put in, and had fastened itself by its mouth to the glass, the efforts of the stickleback to seize and tear it from its hold were incessant, and never failed to succeed. It darted at the loose extremity, or when both ends were fastened, at the curve in its middle, seized it in its mouth, rose to near the surface, and after a hearty shake (such as a dog would give a rat) let it drop. The leech, who evidently wished to avoid its enemy, upon its release again attached itself by its mouth to the glass; but again and again the attack was repeated, till the poor leech became exhausted, and ceased to attempt holding itself by its disc. The stickleback then seized it by the head in a proper position for swallowing, and after a few gulps the leech disappeared. The *H. complanata*, being of an ovate form, and having a hard skin, was not attacked, unless when very young, and scarcely two or three lines in length;*

* It may be mentioned as a curious instance of the wonderful arrangements of nature in securing the continuance of species, that the young of the *H. complanata*, which I have generally found attached to aquatic plants, were, in one instance which fell under my notice, affixed to the under surface of the parent leech. This animal, which, unlike most of its congeners, never swims, had fastened itself to the side of the glass, and three young ones, about a line in diameter, were thus exhibited to view in a most interesting light for an animal so low in the scale of existence. Thus protected, there was nothing to fear from the attacks of the stickleback, or other enemies. They moved occasionally on the disc of the mother, and it is conjectured might remain in that situation, until they had attained such a size as to render further care on the part of the parent unnecessary. To convince myself that this protection was requisite, I detached one with the point of a knife, which was instantly devoured by the stickleback. The young *H. complanata*, from its transparency, forms a beautiful object for the microscope.

and leeches of the other species, when pretty well grown, or longer than himself when expanded, were killed in the manner above-mentioned, but not swallowed. In one of his attempts to seize a leech, the stickleback having got it by the tail, the animal curled back, and fixed its disc upon its snout. The efforts of the stickleback to rid himself of this incumbrance were amusing. He let go his hold of the leech, which then hung over his mouth, and darting to the bottom and sides of the glass with all his strength, endeavoured to rub off this tantalizing morsel. This lasted for nearly a minute, when at last he got rid of the leech by rubbing his back upon the bottom of the vessel. The leech, perfectly aware of the company he was in, no sooner loosed his hold than he attempted to wriggle away from his devourer, but before he had reached midway up the tumbler, the stickleback had turned, and finished the contest by swallowing him up.

"This voracious little fish not only preys upon the young of the leech, but sometimes devours the fry of its own species. In two or three instances, when leeches had not been procured, a young stickleback, about half an inch long, was dropped into the glass, and instantly swallowed. On other occasions, when some of the larger size were put in along with him, he contented himself with killing them. Perhaps the spines of these larger fish, which are erected when in danger, and upon the death of the animal, were too strong for the texture of his throat. In the ponds and ditches where sticklebacks occur, the young fry will always be found to seek protection in the shallowest parts of the water from their full-grown enemies. Our stickleback, at another time, when two minnows, much larger than himself, had been put in to keep him company, attacked them with fury. They fled from his bite in evident dismay; and one of them, finding no other means of escape, fairly leaped out of the vessel. Even a female of his own species was not better treated by this ungallant tyrant, who allowed no stranger to enter his domain with impunity.

"The young of the leech being thus, it is conceived, a frequent food of the stickleback, it is not marvellous that such a little devourer should occasionally gorge himself by swallowing a leech of large dimensions for the capacity of his stomach. That this was the case of Mr. Ramage's stickleback, seems evident from the situation in which it was found, near the surface of the water, and the facility with which it was caught. Leeches possess the power of contracting and expanding themselves to a great degree; and it is not in the least surprising, that, when released from pressure by the death of the stickleback, and swelled by liquid, Mr. Ramage's leech should appear to be larger than the animal that had swallowed it. That it could have lived in the stomach of the stickleback from the period when it was very young, till it attained the size mentioned by Mr. Ramage, is very improbable. From the circumstance of sticklebacks feeding on leeches with avidity, it may be inferred, that nature has provided them with the means of digesting this species of aliment; and the fact of their being fed for weeks on leeches alone, and the usual processes of digestion and excretion going on, raises this inference to absolute certainty. That an animal so tenacious of life as the leech, should, shortly after being swallowed, be found alive in the intestines of the stickleback, does not, therefore, appear wonderful, and that the stickleback should have died when 'a few minutes' out of the water, and in the hands of a child, is still less so. The wonder would have been, had it continued to exist in an element so foreign to its nature, independent altogether of the danger of leech-birth in the hands of such assistants."

IMPERIAL MEASURE.

Sir,—In answer to the inquiry of Cay Ess, of West Brixton, in No. 133 of your valuable Magazine, for a *fractional multiplier* by which to find the contents of a cylindrical vessel in imperial gallons, I beg to give the circulating decimal, 0028333; but recommend, as the easier and also more accurate method of obtaining the answer, to multiply by only 0028, and to the product add one-third of the multiplicand, their sum will be the answer in imperial gallons and decimal parts; or, by another method, sufficiently accurate where extreme accuracy is not required, let one-sixth of the answer produced by the method which Cay Ess has been used to, be subtracted from itself, and the result will be imperial gallons.

I will, for better understanding each other, adopt the question of my inquirer in the annexed example.

I am, Sir,
Yours respectfully,
W. T. R. (a Blue.)

March 11th, 1826.

EXAMPLE.

Suppose the diameter of a cylindrical vessel to measure 21 inches 5 dec., and the depth of oil or other fluid is 76 inches 25 dec., required contents in imperial gallons.

Multiply 21,5
by itself 21,5

3225
430

46225
Multiply by depth.... 76,25

231125
92450
277350
323575

352465625
Decimal fraction.. ,0034

1409862500
1057396875

119.83831250

or

	galls.	qts.	pts.	gills.	
Answer....	119	3	0	2,	old measure
6					
	19	3	1	3,	one-sixth
	99	3	0	3,	new measure

× 352465625, multiplicand as above,
0028

2819725000
704931250
117488541 ⅓ of above multiplicand

99.86526041

or
99 3 0 3, new measure, as above.

THE VACUUM WORKING POWER.

SIR,—In the description of the Vacuum Working Power, given in No. 130 of your valuable Magazine, the happy inventor, Mr. Z., with a modest distrust (it must be confessed) of the success of his machine, says, "Now I come at once to the question on which the whole depends, namely, will this one quarter of water be counterpoised by weight in EE equal to its own weight?" I can assure Z. it will not, nor will it be counterpoised by any weight less than that of AA, filled with water, without the plunger, C, consequently his perpetual motion machine will be motionless; his AA being rendered air tight by the valve in the bottom will avail him nothing. I conjecture, therefore, Z is a zany, certainly not a Y Z (*wise head*).

I remain, Sir,
Your obedient servant,
ARGUS.

NOTICES TO CORRESPONDENTS.

The complaints of Aurum, and one or two other Members of the Mechanics' Institution, seem but too well founded; but after what has passed, we are averse to interfere. We have not, however, positively decided. The members of the working class are themselves not free from blame. After the manner in which (in London, we mean) they have given themselves up to the guidance of their gentlemen associates, and the real indifference they have shown as to the choice of their office-bearers, they must lay their account with a hard struggle, in attempting to regain their proper share of influence.

W. S. will favour us by sending the description to which he alludes.

M. Jones in our next.

Communications received from—T. M. —Fides Defensor—Trebor Valentine—A Hertfordshire Farmer—W. C., Scarbro'—H. Y.—Lieut. H.—(all of whose papers are intended for insertion as soon as the engravings are prepared.)—S. N. L. —Tim O'Houlahan—H. H. A.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills, Jowett,* and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

Mechanics' Magazine,

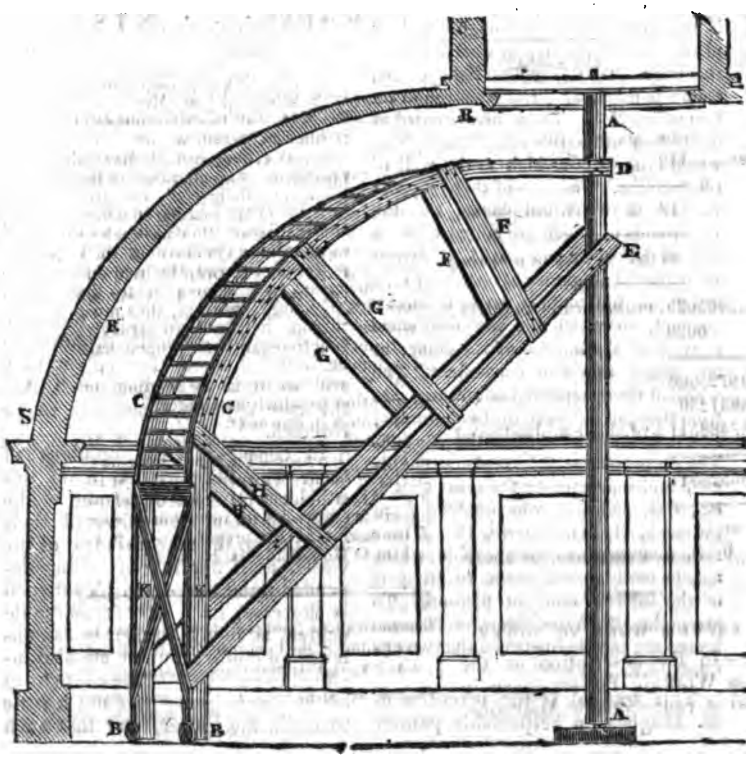
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 135.] SATURDAY, MARCH 25, 1826. [Price 3d.

"By this mean the Arts and Sciences were disseminated, transplanted, indulcated, and even made to flourish throughout the whole kingdoms of Europe."—*Dr. Smith's Treatise on the Arts and Sciences.*

ELEVATION OF A SCAFFOLD FOR REPAIRING THE INTERIOR OF DOMES.

INVENTED BY MR. G. HUGHES.



TEMPORARY SCAFFOLD FOR REPAIRING THE INTERIOR OF DOMES.

INVENTED BY MR. G. HUGHES.

SIR,—If you think the following description (and the plan which accompanies it) of a temporary Scaffold for repairing the Interior of Domes, worthy of insertion in your invaluable Magazine, I should feel obliged if you will give it a place.

This scaffold is contrived to move round on an upright pole in the centre of the dome, and on two wheels running on the floor, so that it can be turned to all parts of the interior of the dome.

The drawing represents an oblique elevation of the scaffold as erected in the dome, RR, of the building, S. The chief support is a straight upright pole, AA, which turns on a pivot at the top, supported by a piece of wood fixed across the top of the dome in the centre, and is supported at the bottom on another pivot, resting in a step of wood fixed on the floor. To this pole a light braced frame is fixed, and traverses round on two rollers, BB. These are situated at the bottom of the two upright legs, KK, which are nearly as high as the wall of the building. The tops of these support the ends of two curved planks, CC, the upper ends of which are bolted on each side of the centre pole, at D. Between these planks a number of boards or rails are placed horizontally, so as to form a scaffold, on which the workmen stand to work at the interior of the dome, at any height they find convenient. The width of these steps gradually diminishes from the space between the two uprights, BB, to a very small width at the pole at E. The curved planks, CC, are also strengthened and supported by the short braces, FF, GG, and HH, which extend from the stays, II, to the curves, CC. These form a strong and secure scaffold, which may be easily moved round to any part of the internal dome at pleasure. To strengthen the frame sideways, diagonal braces are supplied between the two uprights, KK.

This scaffold is the invention of G. Hughes, a respectable painter and plasterer, who resided, a few years ago, at Manchester. It was used for repairing and beautifying the Exchange of that town, and the expense of its erection did not exceed four pounds; the estimate for a scaffold on the common plan, for the like purpose, would have been forty or fifty pounds. The inventor was rewarded by the Society for the Encouragement of Arts, &c. with a silver medal.

In cases where the elevation of the dome is very considerable, a great degree of security might be obtained, by the addition of a railing to the scaffold.

I am, Sir,

Yours very truly,

A MECHANIC AND SUBSCRIBER.

London, Feb. 20, 1824.

HINTS ON SHIP-BUILDING.

Ship-building is an art which concerns England, perhaps, more than any other nation, and we are therefore happy to perceive that it engrosses public attention so much as it does at present.

The Government has shown a laudable example in the three vessels lately built for experiment; and, although their performances may not equal the expectations of their architects, yet even failure will be useful in bringing to view objections that were not foreseen; and although experiment is generally supposed to be founded upon theory, yet they are so intimately connected that the case appears sometimes to be reversed.

In considering the opinions of those who have written upon this subject, we perceive that almost the whole of them have directed their attention to the external form of the vessel, as if her rate of sailing depended upon that *alone*. That such is the case, in a very remarkable degree, no one in his senses can entertain a doubt; but we are also inclined to believe that the *elasticity of the hull and rigging* have not a little to say in the matter, and that such

is the case, we think it will be no difficult matter to prove from experiment.

Thus we find that slight built, elastic vessels, almost invariably sail better in moderate weather than strong built ones. The French were so well aware of this during the late war, that their privateers were sometimes built with their beams to unship when chaced, in order to increase their elasticity, and the shrouds are often slackened upon the same principle.

Oftentimes a vessel sails well when new, but loses her speed when she becomes old; that is, she preserves her sailing as long as she preserves her elasticity.

Sometimes, again, a ship loses her sailing after being repaired. This was remarkably the case (if we rightly remember) with the Barbadoes frigate, the fastest ship out of France; she lost her sailing after being repaired at Portsmouth, although the model was scrupulously preserved. Our inference is, that her elasticity must have been diminished.

Any one who has ever pulled in a boat must be aware how difficult it is to do so, if it has no spring in it, however beautiful the model may be. If the oars have no spring in them, it is still more disagreeable, although their form may be perfect.

We, therefore, conclude that elasticity in the hull and rigging of a vessel have a similar effect with respect to her sailing that a fly has to the movement of machinery.

Suppose a vessel sailing with a light breeze a-beam, but a good deal of sea, so as to make her roll considerably, it is evident that, when she rolls to windward, the sails acting against the wind will tend to accelerate her motion; but, when she rolls to leeward, the sails will flap against the masts, and the wind will be shaken out of them—this will retard her motion. In this case, we conceive that the influence of the breeze, with reference to her progressive motion, will be the same as if she sailed in a sea perfectly smooth, but subject to breezes and calms alternately, at intervals of a few seconds. The tendency of the elasticity here recommended, would be to equalize the pressure of the breeze, and retain its effects for a time after it had ceased; for the sails pressing against the air, have the same effect as the air pressing against the sails.

We find that, in fleets, every vessel has a tendency to draw a-head when she meets with her favourite breeze. Slight-built ships have the advantage in light airs, being most elastic; strong-built ones sail best in stiff breezes, as it requires a greater degree of pressure to bring their elasticity into action; and teak ones are generally heavy sailers, having but little elasticity.

We will even go farther, and say, that to arrive at the *ne plus ultra* of ship-building, the elasticity of the rigging ought to be proportioned to that of the hull, and both to the strength of the breeze; and although this may be difficult in practice, we are by no means disposed to admit of its impracticability.

Let it not be supposed that we recommend ships being built as slight as possible. All that we intend is, to lay down certain rules, which, if found correct, may be adopted by practical men as far as they find them consistent with safety.

If we were to give an opinion respecting the building of small pleasure-boats, we should say, let the ribs be of steel, the masts and spars of lancewood, the stays of hair or of the esparta rush, so generally used in Spain and South America. If these latter cannot be conveniently had, a spiral spring at the lower end of the stay will answer equally well; and let not the seats be so fixed as to prevent the expansion and contraction of the ribs.

In comparing our own merchantmen with those of other nations, particularly the American, we fear there are but few Englishmen who will not blush at the conclusion.

Now, there can be no physical reason why John Bull should not build as good ships as Jonathan; we must, therefore, attribute his not doing so to other causes, and these we take to be, *the facility of intro-*

rance, and the present method of calculating tonnage.

As the law now stands, a ship can be easily insured for *at least* her full value, which tends to make the merchant careless what kind of one he employs, for, if wrecked, the loss falls upon the underwriters; whereas, if he could only insure her for three-fourths of her value, we think that he would be rather more circumspect in his choice, and probably a considerable portion of the *tubs* we see in our ports would never go to sea again. This we do not think would be a great national loss, for we consider it a prostitution of the English flag to see it hoisted upon many of them; and, to hazard them on the deep, we conceive to be little less than sporting with the lives of gallant men. But the other objection to which we alluded, is of much greater importance, and infinitely more fatal in its consequences.

As the law at present exists, a ship does not pay duty according to her actual tonnage, but according to a fictitious measurement, considerably short of her actual burden. In plain English, the Government having imposed a tax of a shilling, accepts of ninepence, and grants a receipt in full. This looks very much like a practical bull, and reminds us of the reasonableness of Sir Boyle Roche's Bill—*that every quart bottle should hold a quart.*

The legislature has enacted, that stage-coaches shall not carry beyond a certain height of luggage; and it has wisely done so, out of a paternal regard for the safety of his Majesty's subjects. Instead of applying the same principle, however, to ship-building, it indirectly offers a premium for fitting out ships of an inferior description; inasmuch as being built, not for sailing, but for burden, they are generally round bottomed, consequently ill calculated for beating to windward; and when caught in a heavy gale of wind, upon a lee shore, it is unnecessary to point out what is but too often the consequence. The public prints attribute the misfortune to the *weather*, make the usual lamentations over the wives and families of the sufferers, and all is forgotten.

That the merchant should endeavour to save what duty he can, is natural enough. The two largest vessels we have seen were built with that object in view, and their fate is known. But shifting the loss from the merchant to the underwriter does not shift it from the nation, and it is in a national point of view that we wish to consider the question. We believe the President of the Board of Trade to be a man of sense and activity, and therefore hope that he may turn his attention to the subject; satisfied, as we are, that, from a slight modification of the laws in question, British merchantmen would soon become equal in symmetry and safety to any that sail upon the ocean, passages would be shorter, wrecks less frequent, insurance lower, and captures less numerous in war; in fine, that millions would be saved to the nation, and the life of many an honest fellow.

T. O. H.

ENGLISH GRAMMAR.

(*Continued from page* 313, *No.* 132.)

OF THE VERB.

This is the most important part of speech, because no sentence can be formed without it. We cannot ask for what we want, we cannot express a single thought, or describe the state of any person, place, or thing, without the aid of the Verb.

A Verb is the chief word in every sentence, and is used to express being, doing, or suffering.

Being is here to be taken, not only in its common sense of existence, but also in its widest sense, as it denotes the state of being under every circumstance, as, *to stand, to sit, to sleep, to lie, to abide, to be cold, to be hot, to be afraid.*

Doing denotes all manner of action, as, *to fight, to play, to write, to speak, to command, to love.*

Suffering denotes the impressions which persons or things receive. We

are to consider, that as persons or things act, so they are often acted upon. Emily *loves*: here *loves* denotes the action of Emily.—Emily *is loved*: here *is loved* denotes the impression or suffering that Emily receives; for Emily is the object on which the action of loving is exercised.

The name of this part of speech comes from *verbum*, the word; and it is so called because, as before observed, it is the principal word in every sentence.

There are about 8000 Verbs in our language.

The frequent use we have occasion to make of this part of speech will appear in the following

Example.

Unprofitableness itself *is* a sin. We need not *do* mischief in order *to commit* sin; uselessness, when we *might be* useful, *is* enough to *make* us sinners before God. The fig-tree, in the Gospel, *was cut* down, not because it *bore* some fruit, but because it *bore* none. The parable of the talents *is pointed* expressly against the simple neglect of faculties and opportunities of *doing* good, as *contra-distinguished* from the perpetration of positive crimes.

I promised, in my last communication, to point out a method of distinguishing the Participle (a peculiar form of the Verb) from the Adjective: nothing is more easy. I must, however, premise that, in the English language, the same words are frequently used as different parts of speech; and, consequently, before we determine to which of these a word belong, we must consider the purpose for which it is used.

The Participle is distinguished from the Adjective by the former's expressing the idea of time, and the latter's denoting only a quality.

Example.

Loving to be instructed, *moving* in haste, *heated* with zeal. A *loving* child, a *moving* spectacle, a *heated* imagination. In the three former Examples, the words *loving*, *moving*, and *heated*, are Participles; in the three latter they are Adjectives, because they express qualities.

If the learner be not quite expert at distinguishing the parts of speech already treated of, let him write a number of sentences, and mark an *a* under the Articles, *p* under the Pronouns, *ad* under the Adjectives, and *v* under the Verbs.

I dare say, Mr. Editor, you remember what I said about laying a good foundation. Many of your readers may perhaps laugh, and some amongst them *may sneer*, at the simplicity of my undertaking; but, from the scantiness of grammatical knowledge which experience has taught me to believe exists in this country, I am convinced that there are others to whom my observations will be, at any rate, *acceptable*, and that is a sufficient consideration to induce me to persevere in completing the humble task I have commenced.

I am, Sir,

Your obedient servant,

WM. SMITH.

Castle House Academy, Guildford,
February, 1826.

SHOOTING STARS.

To the Editor of the Mechanics' Magazine.

SIR,—Permit me to make a few observations on shooting stars, *alias* meteors, *alias* aërolites, which are well calculated to excite the attention of theoretical reasoners. The properties of these extraordinary meteors are various and eccentric. "Sometimes they appear to our view as a transitory spark, sometimes as a lucid and subtile vapour, and sometimes as with a nucleus of considerable diameter; their colour varies from a faint white to a vivid and fiery red; their height has been calculated at about sixty miles from the surface of the earth, and they are supposed to travel at the immense velocity of sixty miles in a second:

they have been observed from a second of time to that of several minutes; some appear to pass into the infinity of space, some to dissolve and vanish in the atmosphere, but the greater number to fall directly to the earth; they are sometimes accompanied with a sharp hissing sound, sometimes they emit a sulphureous effluvia, and those that fall to the earth are found, on immediate inspection, to be much heated."

What an open field, Mr. Editor, do these meteors present to the speculative philosopher! and what an acquisition to our knowledge would it be to know precisely their nature! Your Correspondent, Mr. Farey (in Part xxx. No. 129, page 102), observes that, by an *abundant* series of observations, he is satisfied that these meteors are satellitulæ, or little moons, having elliptical orbits, which, when they partially touch our atmosphere, constitute shooting stars; when they dip lower they come under the head of meteors; and when still lower, so as to cause them to come to the earth's surface, meteorolites or stones from the clouds. This hypothesis is not entirely *new*. A similar belief was entertained by some of the ancients, and has been warmly advocated by some of the learned among the moderns. However, the objections against this theory need no particularizing; they are obvious and many. Anaxagoras (who predicted the fall of one of these meteors, and which fell agreeable to the prediction) supposed them to be matter ejected from the sun; La Place supposed them to be volcanic eruptions from the moon. Some philosophers have supposed them to be generated in the atmosphere, and ignited by electricity; and some, that they are a kind of nebula, existing in vast quantities in space, and coeval with creation, set on fire by causes unknown, and gathering density by motion! which falls in very agreeably with Sir Richard Phillips's theory (of which see page 15), and doubtless with my townsman, Mr. Pasley's notions. Yet *none* of these hypotheses will apply strictly to all cases, therefore they are necessarily rejected; but it is to be hoped that, in this age of discoveries, this yet unexplored part of creation will not be suffered to remain longer in the back ground, if it be possible, by a regular course of observations, to develop their nature.

I am, Sir,

Yours respectfully,

PHILO-TWIST'EM.

Chatham.

INDIAN GUN-BARRELS AND SWORD-BLADES.

The Gun-barrels and Sword-blades made in Bombay, in imitation of Damascus, are much esteemed by the Orientals; the former for the beauty of their twist, and the latter for their excellent temper. The following description of their mode of manufacture, furnished by Capt. M. E. Bagnold, of Bombay, to his brother, Mr. T. M. Bagnold, and transmitted by the latter to the Society of Arts, may be useful, as well as interesting, to the European workman:—

"The gun-barrels made at Bombay, in imitation of Damascus, so much valued by the Orientals for the beauty of their twist, are manufactured of iron hoops, obtained from European casks, mostly British. The more these hoops are corroded with rust, they are proportionably acceptable to the workman: should there be any deficiency of this necessary oxydation, they are regularly exposed to moisture, until they are sufficiently prepared for welding. Being cut into lengths of about twelve inches, they are formed into a pile, an inch or an inch and a half high, laying the edges straight, so as not to overlap each other: a longer piece is then so fitted as to return over each end, and hold the whole together in the fire. This pile is then heated to a welding heat, and drawn out into a bar of about one inch wide, and one-third of an inch thick; it is then doubled up in three or more lengths, and again welded and drawn out as before: and this operation is repeated generally to the third or fourth time, according to the degree of fineness of twist required. The bar is then to be heated about a third of its length at a time, and being struck on the edge, is flattened the contrary way to that of the stratification. This part of the operation brings

the wire or vein outwards upon the strap. The barrel is then forged in the usual way, but much more jumping * is used than in the English method, in order to render the twist finer. The most careful workmen always make a practice of covering the part exposed to the fire with a lute, composed of mud, clay, and the dung of cows or horses, in order to guard against any unnecessary oxydation of the metal. When the barrel is completed, the twist is raised, by laying the barrel, from one to five days, either in vinegar, or a solution of the sulphate of iron, until the twist is raised; this process is called the *wire twist*.

"To produce the *curl*, the bars or straps are drawn into bars about three-quarters of an inch square, and twisted, some to the right, and others to the left hand; one of each sort are then welded together, doubled up and drawn out, as before described; and, according to the skill and experience of the workman, any intricacy of twist is produced by this drawing out, doubling, and twisting.

"Sometimes, to save trouble, and economise the iron thus prepared, the artist will rough file an English barrel, weld a strap of Damascus iron spirally round it, or several straps are laid longitudinally along it, and welded on. A native artist never works with pit-coal, under any consideration; charcoal from light wood forms his only fuel.

"In making the sword-blades, there are several methods used: some workmen make a pile of alternate layers of softer and harder cast-steel, with powdered cast-iron mixed with borax, sprinkled between each layer.† These are drawn out to one-third more than the length of the intended blade, doubled up, heated, twisted, and reforged several times; the twist is brought out in the same way as that in the gun-barrels, namely, by the use of vinegar, or a solution of sulphate of iron.

"Some sword-blades are forged out of two broad plates of steel, thus prepared, with a narrow plate of good iron welded between them, toward the back, and thus leaving solid steel for the edge of a considerable depth.

* "Or upsetting endways, by striking the barrel against the side of the anvil, whilst it is of a welding heat.

† "The soldering steel or iron with cast-iron and borax, and welding afterwards, thus seems to be an Eastern practice!

"Others prefer to make them of one plate of steel, with a lamina of iron on each side of it, to give it strength and toughness.*

"Swords of this description were tempered in my brother's presence, in the following compound; and, as he states, with considerable effect.

The Hardening Composition.

"The blade was covered with a paste, formed of equal parts of barilla, powdered egg-shells, borax, common salt, and crude soda, heated to a moderate red heat; and just as the red was changing to a black heat, quenched in spring water.

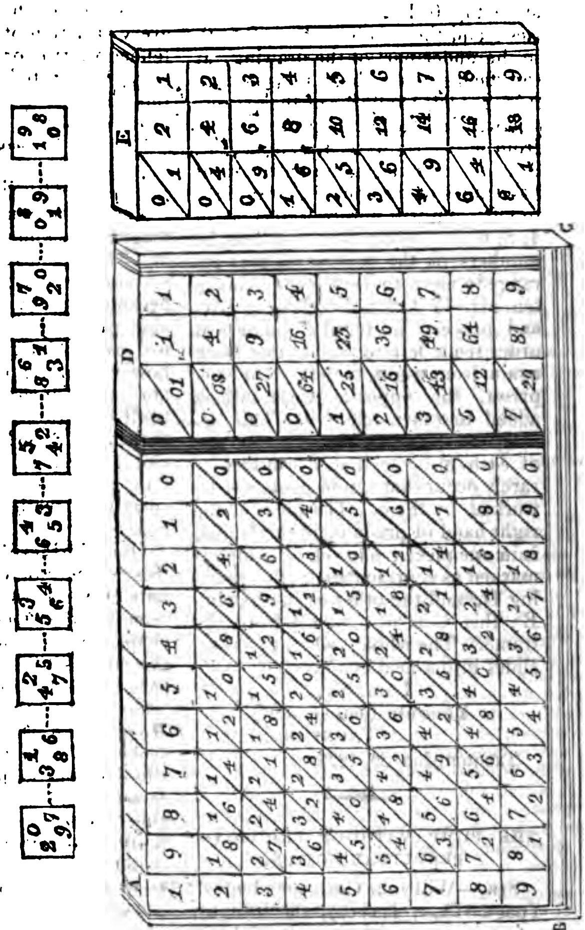
"From the information of the workman, it appears that Damascus obtains all its steel from the upper part of the Deccan, where it is called *fonlode hind*, or Indian steel, of which there are great quantities, but little or no demand for it. The *Damasque* (or *jour*) is natural to this steel; and the veins in it are raised by immersing the blades in acid solution."

* Mr. Gill has found one of these celebrated blades to be composed of plain and hard steel or wootz in the middle, to form the edge: iron at the back, and the mixture of veined steel on both sides, to give it strength, toughness, and beauty.

PORTABLE PENDULUM.

For civil and military engineers, and other practical men, it is highly useful to have a portable pendulum, made of painted tape with a brass bob at the end, so that the whole, except the bob, may be rolled up within a box, and the whole enclosed in a shagreen case. The tape is marked 200, 190, 180, 170, 160, &c. 80, 75, 70, 65, 60, at points, which being assumed respectively as points of suspension, the pendulum will make 200, 190, &c. down to 60 vibrations in a minute. Such a portable pendulum may be readily employed in experiments relative to falling bodies, the velocity of sound, &c. The pendulum and its box may go into a waistcoat pocket.—*Dr. Gregory's Practical Mechanics.*

NAPIER'S BONES.



SIR,—In your 3d vol., page 111, your Correspondent, "Legis," requests a description of this mechanical invention, which you have given in part in the same vol., p. 185; and I find also, in p. 253 of the same vol., an account of a somewhat similar invention, by H. Goodwin, Esq. Having a set myself superior, I think, from the description above-mentioned, to either of them, I beg to offer a few observations, which will, I conceive, enable any cabinet-maker to furnish some for sale. The above drawing is the exact size of the original, which is of box; the square, ABC (of the thickness of the prisms), is fixed on a thin piece of wood, on which the prisms are placed as wanted for use. These prisms are ten in number, and marked in the top squares with the units from 0 to 9 inclusive—these, not at random, as your description would imply, but with the greatest arithmetical precision. In my draw-

ing of the tops of the ten prisms, you are to suppose them placed on the board, with the sides numbered at the top, 0, 1, 2, 3, &c. *lying undermost*, and the numbers from 9 to 0, in the under part of the drawing, at top facing you; then, if you examine the left hand side of the prisms, you will find the figures progressively from left to right, 2, 3, 4, 5, 6, 7, 8, 9, 0, 1. Looking again on the right hand sides of the squares, from right to left, you will find 8, 9, 0, 1, 2, 3, 4, 5, 6, 7. Again, you find that the numbers on the prisms (as here arranged) next to each other, make ten, viz.—7 3, 6 4, 5 5, 4 6, 3 7, &c. and proceed in regular numerical order from left to right, and back again from right to left. On each prism, the opposite top-numbers added together make 9. This arrangement causes there to be four of each unit, so that it would very rarely occur that a sum could not be worked by them. The piece at the right hand of prism 0, in the frame, is in one piece; one side of which is marked as represented in the drawing D, and the other as in drawing E; this is also separate from the frame. The whole, when together, slides into a neat box-case.

I am, Sir,
Your obedient servant,
TAUNTONIENSIS.

Taunton, Jan. 30, 1826.

THE PUMP WITHOUT FRICTION—PERPETUAL MOTION.

SIR,—Will your Correspondent, Z. (page 414, vol. ivth), the inventor of the pump *without friction*, be so good as to give a diagram of the proper lines, by which I may cut the leather flanges, as I am wholly at a loss how to get them, that they may work freely 12 inches, and still hold water with or without sewing.

And, for the remarks of your reader, J. Welch, No. 127, on the perpetual motion, allow me to inform him that, six or seven years ago, I saw part of an apparatus which I was informed had been at work two years and then taken to pieces. It was a pendulum clock, the spring of which was wound up by the rising and falling of the mercury, acted on in two tubes by the atmosphere, every variation of which, whether it tended to rise or depress the mercury, still acted the same way on the spring.

T— N—.

THE MAGNET.

The attraction of iron by the magnet was known to the naturalists of Greece and Rome, but it is uncertain at what time the Europeans became acquainted with that remarkable property of the magnet which we call polarity; distinct traces, however, of the use of the compass are found towards the end of the twelfth century. There is no doubt that the Chinese knew it long before, and it is very probable that the Venetians obtained some information respecting it while trading on the Red Sea.

Our Northern ancestors were in this respect not behind the inhabitants of Southern Europe, as may be seen in the *Landnamabok*, Part I. chaps. 2 and 7, where we are told that the famous Viking Floke Vilgerdarson, the third discoverer of Iceland, who sailed about the year 868 from Rogaland in Norway, in order to seek for *Gardarsholm* (Iceland), took three ravens with him, which were to serve him as guides; for on letting birds fly on the open sea, and finding them to return, it was considered as a sign of there being no land near, but, if they flew away, the vessel followed them, with a view of reaching the nearest shore. In order to consecrate these ravens for his purpose, Floke offered up a great sacrifice at *Smörsund*, where the ships lay ready for sailing; for "at that time the navigators in the Northern countries had no magnets." As the *Landnamabok* was apparently written at the close of the eleventh century, the polarity of the magnet must then have been known in the North, although the passage just quoted does not imply the actual existence of a regular compass.

ON THE COMBUSTION OF COMPRESSED GAS.

BY MR. DAVIES.

(From the Philosophical Magazine.)

In making, upwards of twelve months ago, some experiments upon the Combustion of Compressed Gas, I accidentally observed a fact, which is, I think, of rather a singular nature.

When the aperture of the burner is, in this case, too large, the flame cannot be maintained, being blown away by the rapid current of the gas. When it is rather small, the flame is under the best circumstances. If the aperture be further enlarged, without being carried to the extent at which the combustion is extinguished, the flame will then be blue, noisy, and agitated, affording very little light. But I found, to my great surprise, that if, when the flame was in this last state, the vessel of the gas was inverted, the flame was instantly changed; and instead of being as I have just stated, it was steady, silent, and powerful. I have repeated the experiment frequently, and with different vessels. In every instance the result has been precisely the same.

It became interesting to inquire into the cause of the phenomenon. I submit with deference the only explanation which I have been able to discover.

The gas, rarefied by heat, being lighter than the atmosphere, has a tendency to move in the direction of the flame when the vessel is held upright. In this case, therefore, it moves with greater impetuosity than it could were the burner in any other position. On the contrary, when the flame is directed downwards, it has a tendency to return upon itself. Thus the ascent of the gas is promoted, and the descent retarded, by the agency of the atmosphere; for the gas being rendered lighter in the way just mentioned, has a tendency to rise in the air on the same principle that a cork rises in water, and its descent is in like manner resisted. The fact might, perhaps, be better illustrated by conceiving air to be forced through water. If the air be urged from the bottom of the vessel, it readily moves by reason of its great levity in the required direction; but if it be forcibly impelled downwards from the surface, as from the extremity of a condensing syringe, it can only be driven to a short distance, and it is then forced back towards the pipe. This case appears to me to be analogous to that of the gas, which, if I am not mistaken, it serves to illustrate and explain. The upright position of the vessel admits, in the case referred to, of the escape of some of the gas unburnt; but when the burner is inverted, the flame, for reasons already assigned, returns upon the stream of gas, and the combustion, which was before imperfect, is then complete.

How far the fact may be susceptible of a practical application, I am not at present prepared to offer an opinion; but the consumption of the gas is, by this mode of burning, very considerable, and I have not yet been able to determine that there is in the combustion of gas under the ordinary pressure, any increase of illuminating power obtained by inverting the burner.

INVISIBILITY OF CERTAIN COLOURS TO CERTAIN EYES.

(From the Edinburgh Journal of Science.)

A variety of cases have been recorded where persons with sound eyes, capable of performing all their ordinary functions, were incapable of distinguishing certain colours; and, what is still more remarkable, this imperfection runs in particular families. Mr. Huddart mentions the case of one Harris, a shoemaker at Maryport, in Cumberland, who could only distinguish black and white, and he had two brothers almost equally defective, one of whom always mistook orange for green. Harris observed this defect when he

was four years old, and chiefly from his inability to distinguish cherries on a tree like his companions. He had two other brothers and sisters, who, as well as their parents, had no such defect. Another case of a Mr. Scott is recorded in the Philosophical Transactions, in which full reds and full greens appeared alike, while yellows and dark blues were very easily distinguished. Mr. Scott's father, his maternal uncle, one of his sisters, and her two sons, had all the same imperfection. Our celebrated chemist, Mr. Dalton, cannot distinguish blue from pink by daylight; and in the solar spectrum the red is scarcely visible, the rest of it appearing to consist of two colours, yellow and blue. Dr. Butters, in a letter addressed to the editor of this work, has described the case of Mr. R. Tucker, son of Dr. Tucker, of Ashburton, who mistakes orange for green, like one of the Harrises. Like Mr. Dalton, he could not distinguish blue from pink; but he always knew yellow. The colours in the spectrum he describes as follows:—

1. Red mistaken for	brown,
2. Orange	green,
3. Yellow, generally known, but sometimes taken for	orange,
4. Green mistaken for . . .	orange,
5. Blue	pink,
6. Indigo	purple,
7. Violet	purple.

Mr. Harvey has described, in a paper read before the Royal Society of Edinburgh, and which will soon be published, the case of a person now alive, and aged 60, who could distinguish with certainty only white, yellow, and gray: he could, however, distinguish blues when they were light.

Dr. Nichols has recorded a case where a person, who was in the navy, purchased a blue uniform coat and waistcoat, with *red* breeches to match the *blue;* and he has mentioned one case in which the imperfection is derived through the father, and another in which it descended from the mother.

In the case of a young man in the prime of life, with whom the writer of this article is acquainted, only two colours were perceived in Dr. Wollaston's spectrum of five colours, viz. red, green, blue, and violet. The colours which he saw were *blue* and *orange* or *yellow*, as he did not distinguish these two from one another. When all the colours of the spectrum were absorbed by a reddish glass, excepting *red* and *dark green*, he saw only one colour, viz. yellow or orange. When the middle of the red space was absorbed by a blue glass, he saw the black line with what he called *yellow* on each side of it. We are acquainted with another gentleman who has a similar imperfection.

In all the preceding cases there is one general fact, that *red light, and colours in which it forms an ingredient, are not distinguishable by those who possess the peculiarity in question.* Mr. Dalton thinks it probable that the red light is, in these cases, absorbed by the vitreous humour, which he supposes may have a blue colour; but as this is a mere conjecture, which is not confirmed by the most minute examination of the eye, we cannot hold it as an explanation of the phenomena. Dr. Young thinks it much more simple to suppose the absence or paralysis of those fibres of the retina which are calculated to perceive red; while Dr. Brewster conceives that the eye is, in spectrum, just as the ear of certain persons has been proved, by Dr. Wollaston, to be insensible to sounds at one extremity of the scale of musical notes, while it is perfectly sensible to all other sounds.

If we suppose, what we think will ultimately be demonstrated, that the choroid coat is essential to vision, we may ascribe the loss of red light in certain eyes to the retina itself having a blue tint. If this should be the case, the light which falls upon the choroid coat will be deprived of its red rays by the absorptive power of the blue retina, and consequently the impression conveyed back to the retina, by the choroid coat, will not contain that of red light.

EARTHQUAKES AT SEA.

There are few observations of greater importance, in reference to the theory of earthquakes, than the determination of the exact time when they are felt at sea. The place where they have their origin, the velocity with which they are propagated, and their probable depth beneath the surface, may be inferred from a series of accurate observations on the effects which they produce, and the time when they are felt at different points on the earth's surface.

The earthquake which was experienced at Lisbon on the 2d of February, 1816, at five minutes past midnight, was felt at sea by the Portuguese vessel, the Marquis de Angeja, bound from Bengal to Lisbon, at the distance of 270 leagues from that city; and it was also experienced by another vessel bound from Brazil to Portugal, at the distance of 120 leagues.

On the 4th of April, 1812, the vessels on the coast of the Caraccas trembled, during the heavy shock of an earthquake, as if they had been on a reef of rocks.

In the earthquake which took place at Chili, on the 19th of November, 1822, the effect on the ships in the bay was such, as if the chain-cable had run out in an instant.

On the 18th of February, 1823, the East India Company's ship Winchelsea, in east long. 85° 33″, and north. lat. 52°, experienced the effects of an earthquake. When the vessel was some hundred miles from land, and out of soundings, a tremulous motion was felt, as if it were passing over a coral rock, and this was accompanied with a loud rumbling noise, both of which continued for two or three minutes.

This effect bears a close resemblance to that which is described in the following extract of a letter from on board the Recovery, of ——, in a voyage from Madeira to Honduras, in February, 1825:—

"In running through among the islands, we were in dread of every schooner-rigged vessel we saw, as these seas swarm with pirates. However, nothing worthy of note occurred till off the island of Ruatan. Between seven and eight o'clock at night, being quite dark, we were all alarmed by a rumbling noise, as if the vessel had been running over a reef of rocks. Every one rushed upon deck, and all cast a wishful look over the side of the vessel, expecting every moment to see her go down. The pumps were sounded, but no water was in the well. It was then concluded, that it must have been a large log of timber which the vessel had come in contact with; but, on arriving in Belize, we ascertained that it was the effect of a smart shock of an earthquake, which had been experienced there at the very time we felt the concussion."

UNDER-DRAINING.

SIR,—Your Correspondent, "Fermor," certainly has proved that he is not much of a farmer or under-drainer. He says, "the land is not too wet in its nature, and that only the low land, subject to floods, needs draining." What! *under*-drain lands for floods! The only way to assist flooded lands is to cut trenches, and a good five-foot ditch to receive their contents, and keep the brooks cleaned out, to send the flood off to the river as soon as possible. But if the land is clay-land, and no gravel under, I insist upon it, it is too wet in its nature, and needs under-draining, and an open ditch at the bottom to receive the drain-water.

As to the opinion of drains "drawing out the moisture in dry weather," it is all folly. Every farmer knows, that drained land takes the least damage in droughts, especially sudden droughts, after a rainy time; the wettest land always dries the hardest, and cracks the most. The more water the earth has within it, the more that earth must contract when the water is dried out of it.

But I have seen drain land wetter, crack more, and have a less crop than other land; and for this reason—the drains were made according to the mind and will of the workmen, the master knowing nothing about it; and when this is the case, the work seldom lasts. Workmen will always study their own advantage, and not their master's. When the drains only run for a year or two, the land is worse than land not drained at all, because the furrows are loosened, and all the depth the spade has lightened up the earth, there the water

lodges, or what the farmers call "holds the water;" whereas land that has the furrows firm, causes more of the water to flow over, and goes off as (what we call) top-water. I have told persons whom I have seen throwing their money away, that their land would be worse in three or four years than if it was not touched. What! trust a drainer to do the work just as he pleases—a work wherein deception is the easiest practised of almost any work! There are several gentlemen, just by London, who have lately been employing some men to under-drain. Only a few days ago I saw some of them at work; and I tell them, for their *comfort*, that they might almost as well throw their money away. I have questioned some of these chaps about their work, and they all tell me, "it won't draw if the drains are put in deeper."* You lie, you rogues, you can't *keep the water out*. But the truth is, they do not like to go into the solid—no, no, they love to be niggling about the top, where it digs easy, and so as they can get over the most ground. "How can we yearn the mooast munnee?" that is their question. I told one that his master was throwing his money away; "Oh, he's got plentee a munnee," was the answer; "and if he warn't to do this, he'd spend it in some fool's way or other." Well, that may be true. These chaps love to work for gentlemen, and they would almost as soon see Old Harry come into the field, as such a person as me. What folly! what ignorance it is, to expect a subterraneous passage to remain after the wood and straw are rotted! If the drain is put in shallow, the feet of cattle, and the cart-wheels, when the land is moist, must force in the arch that the clay has formed; while the object in under-draining is, that the wood and straw should hold up the clay till it has settled, and formed a little arch. Many a workman puts in such a small quantity, that the earth has nothing to support it; so down go the few bits of wood to the bottom, and down goes the earth after it. The land is then worse than before, and persons not knowing the cause, form a bad opinion of under-draining. I saw some ploughed land near London drained (as they called it), and I walked up a furrow after the plough, only two years after, and in went the drain at every step; and in one place the plough took off all the earth, and left the wood bare.

Oh! precious, precious shallow draining! and more precious still the shallow pate that could be so shallow as to pay a set of fellows—the vilest set of impostors that ever used a spade—for doing work that would injure instead of benefiting the land!

But if drains are filled up with *shingles* (round stones, the size of a pullet's egg), or if draining tiles are put in, the drains do not require so great depth, because they remain a substance. I think, Sir, you would do the cockney farmers a benefit, were you to expose the shallow draining a little.

I am, Sir,
Your obedient servant,
T. M.

* There is here and there a little of such land, but it is but a little any where near London.

BLOWING HOT AND COLD.

SIR,—In replying to Satyr, I feel myself placed in a peculiarly awkward situation, for I have perused his letter several times, and cannot find out what is his drift. If it is intended as a contradiction to my explanation of blowing hot and cold, it rather confirms what I said, than weakens my argument; for he gives the very same interpretation as I do, with this difference, that mine is as simple as possible, while Satyr mystifies his with as much cant as can well be allowed. He sets out with declaring, that he did not know of "*my* well-known fact," that we blow hot and cold with the same breath. Now, I deny that it is *my* well-known fact, as it was known many years ago, long before I was born, as the fable will testify. He then allows the fact, by saying he blows his fingers to warm them, and his soup to cool it. By sound logic, it follows he must blow hot and cold; and yet he wishes to persuade himself and others that it is not so; that although he does cool his broth by blowing it, yet he does not blow cold. There is in this reasoning a spice of the common sense philosophy, lately so admirably exposed in your columns by T. B. It is not necessary for me by arguments to show that we do blow cold; every person possessing a grain of *common sense* must perceive it—at least, those who are not disposed to quibble and split hairs in philosophy.

The experiment Satyr offers to our notice as an example falls short; because the two hands must, by previous immersion, have acquired different temperatures, and then being placed in another temperature, unlike either of the former, it will of course have the effect he describes; but if, when your hand is cold, you blow on it violently, it will make it feel still colder; but blow softly and *vice versa* will be the case. In fact, Satyr's experiment is only the reverse of blowing hot and cold, and rather bears me out.

I will not occupy any further of your valuable paper, but feel myself bound

to answer Satyr, as silence might be supposed to give assent to any objection which might appear in his letter. I have only one remark more to make, and that is, I think Satyr has exemplified my assertion, in a moral sense, by blowing hot and cold in his letter with the same breath.

Let madmen follow error to the end,
I, of mistakes convinced, am proud to
mend;
Strive to act better, being better taught,
Nor blush to own the change which
Reason wrought;
For such a change as this, let Justice
speak—
The heart was honest, though the head
was weak.

With these lines, as appropriate, I shall conclude, by remaining

Your obedient servant,

T. M. B.

DEFECT IN CARTS.

SIR,—I am a Hertfordshire Farmer, and would be much obliged to you if you would solicit some of your ingenious Correspondents to invent an instrument to enable a wheelwright to fix the iron arms of a haycart on the axletree so truly as that the wheels might work parallel to each other.

I work three hay-carts three times a week to London, and have five carts, none of which go true, though all made by different wheelwrights; in fact, they have no other instrument to set the iron arms true by than the chalk lines, a very rude and insufficient implement.

The excessive labour that is unnecessarily imposed on the horses by the defect I complain of, must be my excuse for this application, particularly as our roads, from St. Albans to London, are as hollow as any other bubble in these bubbling times (thanks to Mr. M'Adam), for we can hardly get along at all upon them now.

I am, Sir,

Your obedient servant,

A HERTFORDSHIRE FARMER.

Hertfordshire, March 7th.

NEW STANDARD WEIGHTS.

[To the Editor of the Mechanics' Magazine.]

SIR,—As many inquiries have been made respecting the *difference* between the *old* and *new* Standard Weights, the following correct Table of the proportionate difference will, perhaps, be acceptable to many of your readers:—

	Drams.	Grs.	
The *new* 56lb. Avoirdupois weight, is	4	0	heavier
28lb.	2	6	ditto
14lb.	1	9	ditto
7lb.	0	10	ditto
4lb.	0	3	lighter
2lb.	0	6	heavier
1lb.	0	0	correct
8 oz.	0	2	heavier
4 oz.	0	1	ditto
2 oz.	0	1½	ditto
1 oz., ½, and ¼ oz., varying from	0	½ to ¼	do.

I am, Sir, yours, &c.

T. S——.

PROPOSITION FOR AMENDING THE COINAGE.

SIR,—In Part 31, of your invaluable Publication, there is a very good article, by J. H., upon the decimal division of money and measures; but I do not approve of his dollars and tenths of dollars, as the present coinage would then be of little use, and the great increase of figures in the first column would be troublesome.

Instead, therefore, of his "proposed Table of Money," I beg leave to suggest the following plan, by which the present coinage may be kept in use, and by that means a great expense saved to the nation.

Let two new coins of silver, and one of copper, be struck. The largest silver one to be denominated "a George," and to be of the value of 2*s*., or 1-10th of a sovereign; the other to be 1-100th of a sovereign, and to be called "a Cent." Let the new copper coin be equal to 1-10th of a cent., and go under the denomination of "a Tenth;" and let all future accounts be kept in sovereigns, Georges, and cents, according to the following Table:—

10 Mites make	.	1 Tenth
10 Tenths	. . .	1 Cent
10 Cents	. . .	1 George
10 Georges	. .	1 Sovereign.

The relative value of the present gold and silver coin will then be—

	Georges.	Cents.	Tenths.
A Guinea, equal to .	10	5	—
A Half ditto . . .	5	2	5
A Sovereign	10	—	—
A Half ditto . . .	5	—	—
A Crown	2	5	—
A Half ditto . . .	1	2	5
A George	—	10	—
A Shilling, or ½ George	—	5	—
A Sixpence, or ¼ ditto	—	2	5
A Cent	—	—	10

The present pennies, half-pennies, and farthings, might be serviceable as component parts of all the coins, except cents, but should, in process of time, be called in, and a new copper coin substituted in their place, of the value of five "tenths," or "half a cent." The old penny pieces are nearly of this value, and with a small stamp upon them, might be re-issued as "half-cents."

I am, Sir,

Your most obedient servant,

H— Y—.

Perth.

INQUIRY.

NO. 181.

SWISS SAW-MILLS.

SIR,—I trust I shall not be considered as seeking information useful to myself only, in requesting any of your scientific contributors to furnish me with a description of a Saw-Mill, of a simple construction, to be worked by a water-wheel. Such are in common use in Switzerland and other parts of the Continent, but I have never met with any thing upon the subject in the Encyclopædias or other works of science; a good description of such mills would, therefore, be a valuable addition to the vast stock of useful information with which your pages abound.

I am, Sir,

Your obedient servant,

VIDI.

P.S. Being in North Wales lately, where streams are very abundant, I frequently heard the subject of the above inquiry discussed, and many complaints of the difficulty of discovering the best method of erecting saw-mills of such a simple construction, and at such a small expense, as would answer the purpose of private gentlemen.

ANSWER TO QUERY.

NO. 115, PAGE 36.

SIR,—In Number 115, page 36, of the Mechanics' Magazine, there

was a query inserted by Philo-Mentis—"Would a bellows (of sufficient size), placed upon the poop of a ship, and worked against a sail, impel it?" Now, I am of the same opinion as Mr. P. M.; because the internal pressure of the air, in the act of compression on all parts of the bellows, except the nose (where there would, of course, be no pressure, as the air would flow freely through it), would act only upon the sail with equal force as upon each part of the internal surface, and therefore it would have equal propensity to go one way as another; and supposing the sail away, there would be nothing to balance the pressure upon the other parts of the bellows, and therefore the ship must go backwards. Upon the same principle, a syphon fixed to a pivot, so as to move round freely in the centre of a tub of water, the hole being on one side the longer leg of the syphon instead of at the end, it will continue to traverse round the tub till it is empty.

I am, Sir,

Your obedient servant,

HAASUL.

NOTICES TO CORRESPONDENTS.

A Correspondent wishes any of our readers, who have a *practical* knowledge of *Whiting's Patent Window-shutters*, would "forward, as soon as convenient, *sketches*, showing their inside and outside appearance, and the manner of their working; together with such explanation that an ordinary person may judge of the safety and convenience of them." "If they can also give some idea of their relative expense, when compared with inside box-shutters, it will greatly enhance the value of the information."

In our last, we censured the members of the London Mechanics' Institution, of the working class, for indifference as to the choice of their office-bearers; T. M. B. maintains that the charge is unfounded, and in proof thereof informs us, that "at the last election more members ballotted than was ever remembered, and only four, instead of five candidates, NOT of the working class, were elected." We were not aware of these facts, and must candidly own that they do manifest an increasing vigilance on the part of the members. The time, however, is not yet long past, when scarcely any body but a managing few concerned themselves about the elections, not one in ten of the members choosing to vote. We are glad to find that so salutary a change has taken place in this respect.

The very useful Table with which Mr. W. has favoured us, shall have a place in our next. We shall be glad to receive, also, the other table which he mentions.

The article on Collars will be inserted shortly; the author's last note shows, however, that the horse is not the only fiery animal that wants bridling.

We do not agree in opinion with S. N. L.; and must defer, for a little while, the insertion of his letter, that we may accompany it with such observations as may prevent the injury it would be otherwise calculated to produce.

Communications are received from—W. C.—Plus—N. R.—Propeller—R. V. K.—A Member of the Rotherhithe Mechanics' Institution—Carbon—John Simpkin—A Civil Engineer—Mr. J. J. R.—Mentor.

*** *Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills, Jowett, and Mills* (late *Bensley*), Bolt-court, Fleet-street.

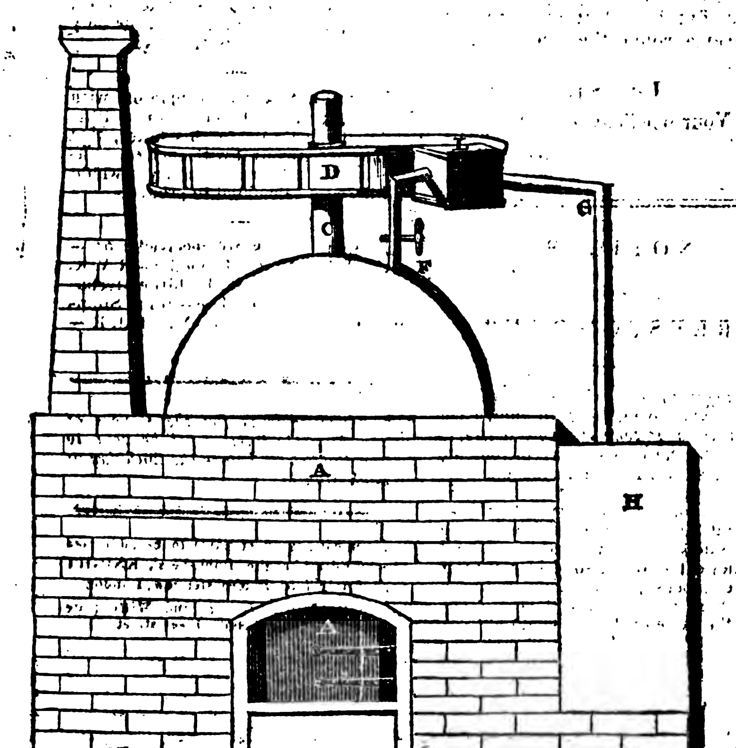
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 136.] SATURDAY, APRIL 1, 1826. [Price 3d.

"That pains we take in books or arts, which treat of things remote from the use of life, is but a busy idleness."—*Fuller*.

MR. SHUTTLEWORTH'S ROTATORY MOTION.



MR. SHUTTLEWORTH'S ROTATORY MOTION.

SIR,—I hope the accompanying drawing and description of a Rotatory Engine may be deemed of sufficient importance to be admitted to a place in your valuable Miscellany, and I shall feel much obliged by any of your numerous Correspondents who will favour me with their ideas respecting it, either through your pages or by letter.

I am, Sir,

Yours respectfully,

M. H. SHUTTLEWORTH.

Tottenham-Green.

References.

AAA, the furnace and brickwork, in which is set,

B, the boiler.

C, a shaft, upon which revolves

D, a wheel divided into chambers by float-boards, or vanes.

E, a box containing two or three chambers, corresponding with those on the wheel in size, open next the periphery of the wheel, but steam-tight.

F, a pipe and cock admitting the steam into the first chamber of the box, which again admits it to a division of the wheel, when it acts against a float, and forces the wheel on till it reaches the last chamber of the box, through which it passes and enters the condenser, G, which delivers it to the condensing cistern, H.

Explanation.

The wheel D may be compared to half a cylinder rolled round a wheel, and divided by semicircular pistons, fixed at equal distances, immoveable and steam-tight. Now the box, E, is a similar semi-cylinder, with pistons corresponding with the other; consequently, when the box pistons are in contact with those of the wheel, a complete cylinder, divided into two or three chambers, according to the power required in the engine, is formed, and the steam being admitted at one end of the bottom, after filling the first chamber, forces the wheel round till it reaches the second or third, the first and second filling again at the same time, when it is finally condensed in the cistern, H, or part may be pumped again into the boiler, as in the usual engines; and by these means, it is presumed, a rotatory motion is produced.

CHEAP SHOES AND SOUND SHIPS.

We make the following extract from a monthly publication called "Britannia's Oracles," by Mr. John Burridge, whose complaints respecting the state of our Navy have lately been a theme of derision in Parliament. It must be confessed that there is a sort of vapourish eccentricity in the manner of Mr. B.'s statements, by no means well calculated to recommend them to serious attention; but that there is any thing so irrational in them as to justify the Honourable Secretary of the Navy in going the lengths he did, it would be difficult, we apprehend, to prove. The passage which we now quote will satisfy our readers that Mr. Burridge has not only been a diligent and acute inquirer, but that there is, in fact, much truth at the bottom of his representations. —EDIT.

"History and experience prove men frequently more indebted to accident than design for many useful discoveries and improvements, often accomplished by the simplest means,—the compass, for instance.

"I have discovered means of ascertaining the relative degrees of the strength in oak-bark liquors. I have also discovered, that simple and regular application of oak-bark liquors, &c. to hides, will effectually tan *sole leather* in three or four months (according to their thicknesses), provided you commence at three degrees, and gradually increase the strength of liquors thrice a week to 15 or 20 degrees, taking care not to apply strong liquors till hides are nearly tanned: there can be no theory prescribed as to the exact time when hides may be forced with advantage—this is the only discoverable art I have found in the course of my researches and experiments, which cost several thousands before I succeeded—practice only can master this nice point.

"I use an hydrometer, which I have surnamed a barkmeter, without which I

should be more in the dark than brewers without saccharometers or thermometers, &c.

"I have also found means, by the constant use of pumps, to extract all the virtue from oak-bark in *ten days*, which generally lies in common yards two or three months. My hydrometer proves I throw no tannin away.

"The execution of this process, with daily care, acquires additional weight in leather over the standard. Tanners, in general, require twelve months to tan hides, that may, by this system, be done in three months with perfect ease. Common tanners are satisfied if a hide of 80 lbs., when raw, yields 40 lbs. when tanned; whereas my process will produce 48 lbs. of leather from similar hides, which is actually one-fifth more leather in a quarter of the usual time. Is not this a plain proof that hides lie rotting, rather than tanning, after four months? because weight is the criterion of the quality of leather, and the least weight is the fruit of the longest time.

"Many tanners immerse crop hides in bark for three months, during which single stage I tan the stoutest hides in the kingdom, without more than the usual quantity of bark, because it is generally acknowledged that four or five pounds of oak bark (according to its quality) will tan one pound of leather.

"A sincere desire to extinguish dry rot in ships first inspired me to seek remedies, because I was convinced it was occasioned by hewing oak at *bark harvests* instead of *winter*, which was the ancient practice when bark was only worth 2s. per cart load, whereas now it is worth 150s.

"I then sought for native substitutes for bark, and found abundant supplies, cheaper than oak-bark, which answered equally well, *except in colour*, as the leather proved rather dark; but I disregard colours, immaterial to customers using blacking.

"Oak faggots yield excellent leather: I have worn boots several years, tanned solely with oak saw-dust—but this is not novel.

"In spite of the scarcity and dearness of oak-bark, prejudices against colour, forsooth, soon decried these native substitutes. In the mean time, naval dry rot continued its monstrous ravages against all experiments in dock-yards, &c.

"I next attempted to seek foreign remedies to preserve Britannia.

"I found the annual importation of bark, &c. from Holland, &c. was about 100,000 tons, and that the consumption (on the acknowledged data that five pounds will tan one pound of leather) is 117,000 tons, which yielded 23,408 tons of leather, or 655,000*l.* duty in 1821.

"Nothing can prove more clearly that England is exhausted of *naval oak*, and that we are dependent on foreign powers for *ships and leather*.

"Plain facts are stronger than volumes of arguments!—and they stimulated me to persevere against innumerable difficulties, instead of abandoning such most irksome pursuits in despair. I turned my attention towards foreign tannin, at last, and my efforts have been crowned with success. I find *Terra Japonica* possesses stronger tannin than any other article. Sir Joseph Banks reported to the East India Company, in 1802, that it was ten times stronger than oak bark; who used their endeavours to encourage experiments and importation, without practical effort or benefit; for, notwithstanding this knowledge, the average importation does not exceed ten tons annually, for medicinal uses.

"The legislature has, however, wisely encouraged its importation, by allowing tanners to use it, on payment of a duty of 3s. per cwt.; whereas the duty on *Terra Japonica*, for all other purposes, is 10d. per pound. The legislature sees the existing scarcity of oak timber, and has reduced the duty from 6*l.* to 2*l.* 15s. per load; it ought to be abolished, to relieve ship-builders.

"The East India Company inform me that *Terra Japonica* is an article of general produce in all parts of India, and that abundant supplies may be obtained.

"To import 10,000 tons would employ 20 ships, of 500 tons, equal to 100,000 tons of bark from Holland. Sir H. Davy also analyzed *Terra Japonica*, and pronounces one pound of it, according to Ure's chemical dictionary, equal to 8½ lbs. of oak-bark. The most extraordinary fact remains to be published—*the present price* is 33*l.* per ton, equal to 8½ tons of oak bark at 10*l.*, or 85*l.*, considerably less than half the present value of bark. Ships may be saved from dry rot—tanners relieved—and every man may expect shoes and boots at reasonable prices."

QUERY.

Archimedes asserted that, with the lever, provided he could find a station for the fulcrum, he would engage to move the earth: allowing that he had found a fulcrum, how long would it take him to move the globe through the space of one inch only?

T. M. B.

A TABLE

OF

FACTORS AND THEIR LOGARITHMS,

FOR FACILITATING CALCULATIONS RELATIVE TO THE NEW WEIGHTS, AND MEASURES.

BY J. W. WOOLGAR, ESQ.

	nat. num.		*logar.*
Old Wine gallon........equal	231·	cubic inches.	2·3636120
Old Corn gallon............	268·8025	——————	2·4294334
New Imperial gallon, containing 10 lbs. avoirdupois of pure water weighed in air; barometer 30 inches, thermometer 62 deg.....	277·274	——————	2·4429089
Old Beer gallon..............	282·	——————	2·4502491
Imperial gallon	1·200320	old wine gal.	0·0792969
——————..............	1.031515	old corn gal.	0·0134755
——————..............	0·983241	old beer g.	−1·9926598
Old Wine gallon..............	0·833111	imp. gal.	−1·9207031
—— Corn ——	0·969448	——————	−1·9865245
—— Beer ——	1·017045	——————	0·0073402
Pound Avoirdupois	1·215278	lbs. Troy	0·0846755
——Troy.................	0·822857	lbs. Avoir.	−1.9153245
Ounce Avoirdupois	0·911458	oz. Troy	−1·9597368
——Troy.................	1·097143	oz. Avoir.	0·0402632
Cubic inch of pure water, barom. 30, therm. 62....	252·458	grains	2·4021892
——————————....	0·577047	oz. Avoir.	−1·7612111
——————————....	0·525954	oz. Troy	−1·7209480
Cubic foot of water..........	75·7374	lbs. Troy	1·8793104
——————..........	908·849	oz. Troy	2·9584917
——————..........	62·3211	lbs. Avoir.	1·7946349
——————..........	997·137	oz. Avoir.	2·9987549
Ounce of water, Avoirdupois..	1·732961	cubic in.	0·2387889
——————, Troy........	1·901306	——————	0·2790520
Pound of water, Avoirdupois..	0·016046	cubic feet	−2·2053651
——————, Troy........	0·013204	——————	−2·1206896

FORMS FOR THE SLIDING RULE,

ADAPTED TO THE WEIGHTS AND MEASURES ESTABLISHED BY THE NEW ACTS.

Conversion of new and old measures and prices.	A	6	old wine measure	or	new price	(1
	B	5	imperial measure		old price	
	A	98	old corn measure	or	new price	(2
	B	95	imperial measure		old price	
	A	59	old beer measure	or	new price	(3
	B	60	imperial measure		old price	
Conversion of solid measure, & measure of capacity.	A	15	pints			(4
	B	520	cubic inches			
	A	81	gallons			(5
	B	13	cubic feet			
Conversion of solid measure, & weight of water.	A	0·99	cubic inches of water			(6
	B	250	grains weight			
	A	26	cubic inches of water			(7
	B	15	ounces Avoirdupois			
	A	83	cubic inches of water			(8
	B	3	pounds Avoirdupois			
	A	97	cubic feet of water			(9
	B	54 [2·7]	cwt. [tons]			
Conversion of Troy and Avoirdupois weight.	A	14	pounds Avoirdupois			(10
	B	17	pounds Troy			
	A	79	ounces Avoirdupois			(11
	B	72 [6]	ounces Troy [lbs. Troy]			
	A	102	ounces Troy			(12
	B	7	pounds Avoirdupois			
Content of a rectangular vessel.	A	Product of 2 dimens.	content, gallons			(13
	B	277¼	third dimension, inches			
Content of do. having a square bottom.	C	Inches deep	content in bushs. [gals.]			(14
	D	47·1 [16·65]	side of square, inches			
Content of a cylindrical vessel.	C	Inches deep	content in bushs. [gals.]			(15
	D	53·14 [18·8]	inches in diameter			
Weight of water in a cylindrical vessel		Inches deep	weight in lbs. Avoird.			(16
	D	5·94	inches in diameter			
Dimensions for the construct. of bush. &c. measures.		bush. 14·4; ½ bush. 7·2; gal. 1·8	depth | B (slide invert)			(17
	D	14	diameter.			

CUBIC EQUATIONS.

Sir,—Mr. Hoyle, in No. 132 of your excellent Magazine, has given what he supposes a perfect solution of the *irreducible case of Cardan's rule*, or, in other words, he has succeeded in solving a problem which has hitherto baffled the united efforts of the most celebrated mathematicians in Europe. Mr. H., no doubt, imagines he has found a diamond; but, alas! on minute examination, it turns out to be only an egg! aye, and what is worse—a stale one! But to be serious. Mr. Hoyle has not attended to what is expected to be done in solving this problem. To find the positive, negative, or imaginary roots, of a numerical cubic equation, to any assigned degree of accuracy, is a problem that involves no difficulty, although it may sometimes be attended with a good deal of arithmetical labour; but, unfortunately for science, no general solution has ever yet been discovered for any *literal equation* above a quadratic, except in some particular cases, of which Cardan's solution of a particular class of cubic equations forms one. Thus,

Suppose $x^3 \pm 3qx \pm 2r = 0$; then, by Cardan's theorem, $x = \left(\mp r + (r^2 \pm q^3)^{\frac{1}{2}}\right)^{\frac{1}{3}} \mp \frac{q}{\left(\mp r + (r^2 \pm q^3)^{\frac{1}{2}}\right)^{\frac{1}{3}}}$.

Now, it is well known that when $3q$ is negative, and at the same time q^3 is greater than r^2, the expression of the root by Cardan's theorem involves impossible roots, when, at the same time, it is known that the three roots of the equation are possible. The reason is from the arbitrary (although very ingenious) notation made use of by Cardan in his solution, as it is necessary to suppose that x, the root, can be divided into two parts, of which the product of the parts is q. But the writers on Algebra have demonstrated that this cannot be done when $3q$ is negative, and at the same time q^3 greater than r^2.

Now, in the irreducible case, suppose we have given the literal equation $x^3 - 3qx \pm 2r = 0$, where r^2 is less than q^3, any one who can discover the three roots exactly in terms of q and r. Or if, by some theorem, he can exhibit one of the roots exactly in terms of q and r (as the other two can be found by a quadratic), he has then found out a *perfect solution* for the irreducible case of Cardan's rule. I will not say it is impossible to be done, but I certainly agree with Bonnycastle—it has hitherto baffled the united efforts of the most celebrated mathematicians in Europe.

All, therefore, that can reasonably be expected to be done, is to find out the shortest way of approximating to the roots of numerical equations when they rise above a quadratic. The following new method of approximating nearly to the roots of numerical cubic equations that fall under the irreducible case of Cardan's rule, has lately occurred to me:—

1st. Let the given equation be $x^3 - qx = r$.

This equation may be transformed into another dependant equation of the form $y^3 - ay = a$, in the following manner:—

Assume $x = ny$, then, by substitution, the given equation becomes $n^3y^3 - qny = r$, or $y^3 - \frac{8}{n^2}y = \frac{r}{n^3}$.

Now, as n may have any value whatever, suppose $\frac{q}{n^2} = \frac{r}{n^3}$; then $qn = r$, or $n = \frac{r}{q}$; hence $y^3 - \frac{q}{n^2}y = \frac{r}{n^3}$ becomes $y^3 - \frac{q^3}{r^2} = \frac{q^3}{r^2}$, and, putting $a = \frac{q^3}{r^2}$, then $y^3 - ay = a$.

Since $y^3 - ay = a \therefore y^2 = a + \frac{a}{y}$, or $y = (a + \frac{a}{y})^{\frac{1}{2}}$; hence the positive value of y is greater than $a^{\frac{1}{2}}$.

$$\text{Let } y = a^{\frac{1}{2}} + z,$$

$$\text{then } y^3 = a^{\frac{3}{2}} + 3az + 3a^{\frac{1}{2}}z^2 + z^3$$
$$- ay = - a^{\frac{3}{2}} - az,$$

$$\therefore y^3 - ay = 2az + 3a^{\frac{1}{2}}z^2 + z^3 = a.$$

Hence $2ax$ is less than a, or x is less than $\frac{1}{2}$. It therefore follows, that whether the equation $y^2 - ay = a$, belongs to the reducible or irreducible case: the positive value of y is between the limits $a\frac{1}{2}$, and $a\frac{1}{2} + \frac{1}{2}$.

I am fearful I have already engrossed more of your valuable space than I am entitled to; I shall, therefore, reserve the remainder of this subject for some future Number.

I am, Sir,
Your obedient servant,
G— S—.

MODE OF SCULPTURING AND CLEANING ALABASTER.

BY MR. HENRY MOORE,
Of Greenhill, Derby.

From Communications to the Society of Arts.

Mr. Moore, taking advantage of a well-known fact, that gypsum or alabaster, or, to speak scientifically, sulphate of lime, is perfectly soluble in 500 parts of cold water, has adopted the following process

To Sculpture Alabaster:

He covers the ornament, and all those parts that are not to be corroded, with a composition that will resist water. Wax, dissolved in spirits of turpentine, and mixed with white lead, may be used with a camel-hair pencil; or turpentine varnish, with a little animal oil and white lead, and will be found to work more freely than the wax. Spirits of turpentine must be used in pencilling with these compositions. The use of animal oil is to prevent the varnish from becoming very hard, which would render its removal, after corrosion, extremely difficult. The ornament, and other parts which are intended to be preserved, being completely covered with the composition, it is suffered to remain a few hours to dry. The article is then put into a vessel of rain water, in which it must remain 48 hours, or longer, according as the ornament may be required to have more or less relief. When the corrosion is completed, the varnish or wax must be removed with spirits of turpentine, which may be applied with a bit of sponge, and then be wiped off with soft rags.

The article, being made quite clean, is now rubbed over with a soft brush, dipped into finely-powdered plaster of Paris, and is applied in the dry state. This powder fills the pores of the corroded parts, giving a certain degree of opacity, similar to that which is left from the tools of the sculptor. It forms a good ground that contrasts well with the ornament, and makes it appear with greater advantage than if left merely in the corroded state.

The alabaster of which the vase is made was procured from a quarry at Chellaston, about four miles from Derby.

To Clean Alabaster Sculptures.

Spots of grease are first to be removed with spirits of turpentine; the article is then immersed in water, where it is suffered to remain about ten minutes, or, perhaps, a little longer, if the thing be very dirty; it is then rubbed over with a painter's brush, suffered to dry, and then treated with plaster of Paris as above, when the article will be found perfectly clean, as if just from the hands of the sculptor.

A piece of sculpture that would take several days to clean by the usual way, with fish skin and Dutch rushes, is, by this process, completed in half an hour.

WOODEN PENDULUMS.

It appears, from two different series of observations made by Colonel Beaufoy, that a pendulum with a rod of *heavy* wood is, in point of accuracy, superior to one made of *light*, the greatest daily variation of a clock with the latter being from minus 2.74″ to plus 1.48″, sum 4.52″; and with the former from minus 2.52″ to plus 9.5″, sum 12.02″.— Whether the exactness of the time

be in proportion to the lightness of the wood, Colonel Beaufoy proposes to make the subject of future experiments.

STANDARD OF MEASURE.

[*To the Editor of the Mechanics' Magazine.*]

Sir,—Among the number of suggestions, in your interesting Magazine, for a Standard Rectilineal Measure, I have not noticed the one given in page 100, of Collet's beautiful book of Logarithms, stereotyped by Firmin Didot. My copy, from which I translate the following extract, is of the impression of 1808, Paris. After showing the application of logarithms to find the axes of a terrestrial meridian, supposed to be of an elliptical figure, having the length of two degrees given, the article thus concludes :—

"A universal measure has been long sought after. It was desired that this measure should be given by nature, and nature offered one to which no attention has been paid. It was natural, however, to say, *we wish to have a measure fit for the whole world*. Well, then, let us take the axis of the earth. It is a *straight* line; it is the distance from one pole to the other. Let us, then, compare with this distance all those that we wish to know. Had this step been taken, the dimension of the ten-millionth part of the earth's axis being called the module, or standard, the mean length of that standard would have been found to be 3 feet 11 inches (French measure), within one-hundredth part of a line; in that case, a straight line would have been obtained for a term of comparison. As for the itinerary, geodesic, geographical measures, &c. they serve for comparing curvilinear distances: but they make a part of the meridian, nothing better."

As so many articles in this country are taxed according to their weight and measure, it could scarcely be expected that greater alterations would be made in our measures than have been made by the late Act of Parliament, although philosophers, engineers, architects, joiners, &c. have many reasons for wishing that our measures of length, in particular, were different. The division of our inches into *eighths* is small enough for carpenters, but not for joiners, who frequently have occasion to set down so many eighths and a sixteenth, the latter fraction being determined by guess. For the sake of small divisions, and to have the advantage of decimals in computation, some of our engineers have had their rules made according to the French metrical system. In our shops, ivory scales are to be purchased, on which the inch is actually divided into sixty equal parts, forming the smallest divisions on such scales. On the back of the diagonal plotting-scale, usually contained in a case of drawing-instruments, there are scales dividing an inch into 20, 25, 30, 35, 40, and 45 equal parts. Perhaps the most generally useful rule would be made by taking the length of the seconds' pendulum, or an aliquot part of it, as the unit, dividing it decimally into smaller parts, so that the smallest divisions should be no farther apart than just sufficient to allow of their being read off easily by the naked eye.

It may be of use to some of your readers to be informed, that there are two useful little works, on the nature and application of Gunter's Line, by the late Dr. Mackay;—the one, the description and use of the Sliding-Gunter in Navigation, Aberdeen, 1802; the other, the description and use of the Sliding Rule in Arithmetic, &c. Edin. 1811.* A clear description of its construction and use in chemistry will be found in Merrick's translation of Thenard's celebrated Treatise on Chemical Analysis, p. 298.

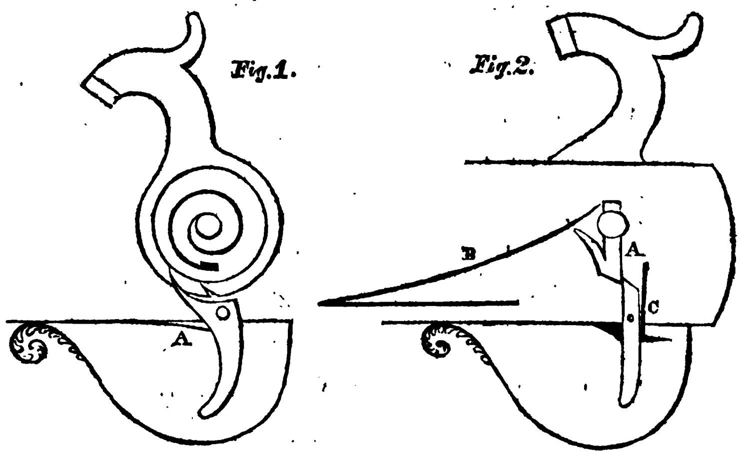
I remain, Sir,

Your obedient servant,

Zero.

* See also B. Martin's Logarithmologia, 1740.

SIMPLE PERCUSSION LOCK.



SIR,—If the following description and sketch of a Simple Percussion Lock, on my plan, is worth a place in your Magazine—as simplicity and economy, combining security and strength, must be desirable in all mechanism—you will oblige by its insertion,

Your humble servant,
G. M. H——N,
Royal Navy.

Description.

Fig. 1 represents the cock of a percussion-gun, its circular part being hollowed of an adequate depth to admit a spiral spring, of sufficient strength, similar to the spring of a watch. One part of the spring being fixed to the axle of the cock, has a small iron square plate sunk in the stock, even with the woodwork, with an axle projecting for placing the cock; the other end of the spiral spring is secured to this iron plate, and a nut-screw to go on the axle, to keep the cock in its place. On the external circle of the cock two grooves are formed for the cock and half-cock: the catch part of the trigger must be without, and come up externally to act on the cock, and made to work by a double axle from underneath. A small spring, A, will act externally on the trigger, for catching the cock; spiral springs, I believe, are objectionable, as more liable to break than others: they are, however, cheap, and may be so applied for this purpose, that any person may, on an accident taking place, even in the field, apply another in a short space of time. This plan will require but little time and attention of persons to clean their locks—a matter of no small consideration, considering how much labour, time, and nicety, are now required by gun-smiths, in hollowing the stock, fitting the lock-plate, and making the works of a lock. As they are paid for all this, the difference is nought to them, but the expense to the purchaser is immense.

Fig. 2 represents the interior of a lock-plate, with the lever, A, projecting from the axle of the cock; this lever ships and unships from off the cock-axle, by being fitted thereon with a square shoulder; the longer this lever the better, so as to meet the trigger, as the shorter the trigger-fulcrum is to act on this lever, the greater the power.

B is the main-spring, fixed to the lock-plate, and acting on the projection of lever A, for giving force to the cock. The small angular piece just before the trigger is a fixture, for preventing the trigger from going more forward, which it otherwise would do, from the force of the spring, B, on the lever; but this projection would answer the same purpose if formed on the trigger itself: this principle is meant to enable you to carry your gun cocked, if desired. Let the lever of your cock and trigger come in contact, so that the cock shall be retained until you apply your finger, as

usual, to the trigger for discharging; to this lever may be given such resistance as a person thinks proper.

When you want to cock your gun, hold the muzzle inclined downwards; your trigger being made to move freely and more weighty externally, will of itself be brought in position to catch when you cock. The bringing the gun to cock in this way, is equally as simple as carrying it now on the half-cock, for cocking; a little practice is all that is required. The axle of the cock must, of course, work within two grooves; one is formed in the lock-plate; and the interior axle, or end part, must work in a groove of a small fixed plate within the outer end part of the stock.

If wanted to be carried constantly in the field (as the French always do) cocked, a spring slide may be easily made underneath, close against the back part of the trigger, as C, and easily pushed up, as you are about to apply your finger to the trigger for discharging.

The Rev. Mr. Somerville, of Currie, near Edinburgh, is said to have invented a very simple "Safety Catch" for a gun on full cock, as mentioned in Number 118, of the Mechanics' Magazine. I, however, think nothing can be more cheap, secure, and simple, than fig. 2: it is with one spring only; and if you do not like to carry your gun cocked, I see no more difficulty in cocking it from its rest on the cap, than from the half-cock, as now in practice, having a slight catch to prevent over-cocking, or rather over-straining the spring, as a long, sudden force may do, from its being completely down on the cap.

HORSE COLLARS, ETC.

Fig. 1

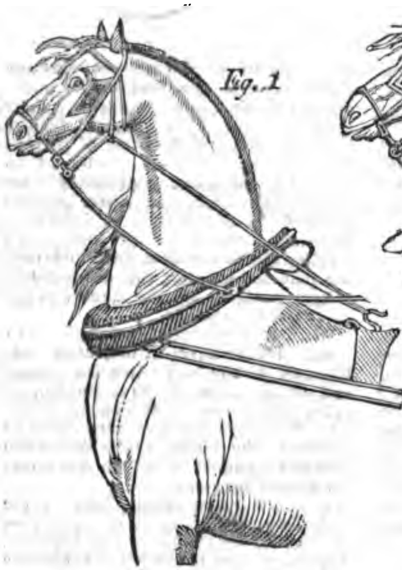


Fig. 2

SIR,—Seeing your work ever open to useful inquiries, I trust this will not be deemed unworthy of your notice.

Being about to buy harness for my horse, I have for a long time considered which were the best, No. 1 or No. 2. (See sketches prefixed.) The former is in more general use, and, until now, I have used it myself; but when in London, I have seen a few instances in which the latter was used, particularly in burial and mourning coaches, and was delighted to observe the comfortable ease with which the horses drew their load. The former appears to wear out the neck and confine the

muscles, and pull the noble beast about at every jolt. I wish, however, to be assisted by the opinions of others, before my old harness wears out, as No. 2 may have faults of which I am not aware, it not being in much use. A hint or two, as early as convenient, from any of your numerous sensible Correspondents, will greatly oblige,

Your obedient servant,

EQUUS.

High-street, Birmingham.

MR. SHUTTLEWORTH'S HAND-SAW MILL.

SIR,—In a late Number of your valuable Publication, you give an account of Mr. Shuttleworth's Hand-saw Mill, the principle of which contains what I conceive to be some very palpable errors.

In the first place, his cog-wheels are so placed, that I do not see how they can gain any thing whatever, as he turns with a winch a wheel, which acts upon another of twice its diameter, acting on a third of the same size as the first, whereby no mechanical advantage is obtained, which evidently appears from the fact of there being no time lost, since the evolutions of the first and third wheels are precisely alike, and yet to the axis of this third wheel he affixes his saw. I submit, that he might just as well apply his winch to the axis of the saw at once; and, in fact, better, for he would thereby save the friction caused by the additional useless wheels.

But it is immediately evident that this would be impracticable, as the power of a man could not give the rapidity of motion to the saw, requisite for its effective operation; nor would his strength, in fact, be equivalent to forcing it through whatever he might be desirous of cutting.

I am, Sir,

Your obedient servant,

Y. Z.

London.

EXPELLING ROOKS.

SIR,—I have been anxious to return you my best thanks for so obligingly inserting in your Magazine a question I sent you some time ago—"How to get rid of a Rookery," &c. but I have deferred doing so, in the hope that I might also have to acknowledge some reply to it. I see one in your last Number, but unless your Correspondent will inform me how his plan is to be executed, I fear I shall not be the forwarder. The nests are on very high elms, from 80 to 100 feet high; they are built on branches too slight to bear the weight of any person, even a very light boy, supposing that one could climb up to them, which would not be very easy. If that difficulty was got over, it would be impossible to remove the nests without pulling them to pieces; and I am afraid it would puzzle any human builder to put them together again with the same skill as the rooks do.

I am, Sir,

Your obedient servant,

AN OLD SUBSCRIBER.

BAROMETERS.

Two papers, by Mr. Daniells, have been lately read before the Royal Society, on the Barometer, which establish the following important facts:—

1. That air gradually insinuates itself into the best made barometers of the common construction,

2. That this does not take place from any solution of the air by mercury; but

3. That the passage of the air is between the mercury and the glass; and,

4. That the gradual deterioration of barometers may be prevented by a ring of platinum cemented to the open end of the tube.

Mr. Daniells, in illustration of these facts, brings forward some curious observations of Dr. Priestley. The latter found, in his experiments upon air, that when he operated with mercury, atmospheric air obtained admission into his jars even when there was an inch of mercury on the outside, and a column of 2 or 3 inches within; and he remarks, that this is owing to there being no complete contact between mercury and glass, and that the air which is confined between the two is continually protruded forward by the vibration of the vessel. He also observed that, when a little water was placed upon the outside of the jar upon the mercury, that neither air nor water ever got in to disturb his experiments.

NARRATIVE OF EXPERIMENTS MADE TO ASCERTAIN THE EFFICACY OF SIR HUMPHRY DAVY'S COPPER SHEATHING PRESERVATIVE.

Communicated by Sir Humphry Davy *to the Royal Society.*

"The very first experiment that I made on harbour-boats at Portsmouth, proved that a single mass of iron protected fully and entirely many sheets of copper, whether in waves, tides, or currents, so as to make them negatively electrical, and in such a degree as to occasion the deposition of earthy matter upon them: but observations on the effects of the single contact of iron upon a number of sheets of copper, where the junctions and nails were covered with rust, and that had been in a ship for some years, showed that the action was weakened in the case of imperfect connexions by distance, and that the sheets near the protector were more defended than those remote from it. Upon this idea I proposed, that when ships, of which the copper sheathing was old and worn, were to be protected, a greater proportion of iron should be used, and that, if possible, it should be more distributed. The first experiment of this kind was tried on the Sammarang, of 28 guns, in March 1824, and which had been coppered three years before in India. Cast iron, equal in surface to about 1-80th of that of the copper, was applied in four masses, two near the stern, two on the bows. She made a voyage to Nova Scotia, and returned in January, 1825. A false and entirely unfounded statement respecting this vessel was published in most of the newspapers—that the bottom was covered with weeds and barnacles. I was at Portsmouth soon after she was brought into dock: there was not the smallest weed or shell-fish upon the whole of the bottom, from a few feet round the stern-protectors to the lead on her bow. Round the stern-protectors there was a slight adhesion of rust of iron, and upon this there were some zoophytes of the capillary kind, of an inch and a half or two inches in length, and a number of minute barnacles, both *Lepas unatifera* and *Balanus Tintinnabulum*. For a considerable space round the protectors, both on the stern and bow, the copper was bright; but the colour became green towards the central parts of the ship; yet even here the rust or verdigris was a light powder, and only small in quantity, and did not adhere, or come off in scales, and there had been evidently little copper lost in the voyage. That the protectors had not been the cause of the trifling and perfectly insignificant adhesions by any electrical effect, or by occasioning any deposition of earthy matter upon the copper, was evident from this—that the lead on the bow, the part of the ship most exposed to the friction of the water, contained these adhesions in a much more accumulated state than that in which they existed near the stern; and there were none at all on the clean copper round the protectors in the bow; and the slight coating of oxide of iron seems to have been the cause of their appearance.

"I had seen this ship come into dock in the spring of 1824, before she was protected, covered with thick green carbonate and submuriate of copper, and with a number of long weeds, principally *Fuci*, and a quantity of zoophytes, adhering to different parts of the bottom; so that this first experiment was highly satisfactory, though made under very unfavourable circumstances.

"The only two instances of vessels which have been recently coppered, and which have made voyages furnished with protectors, that I have had an opportunity of examining, are the Elizabeth yacht, belonging to the Earl of Darnley, and the Carnebrea Castle, an Indiaman, belonging to Messrs. Wigram. The yacht was protected by about 1-125th part of malleable iron, placed in two masses in the stern. She had been occasionally employed in sailing, and had been sometimes in harbour, during six months. When I saw her in November, she was perfectly clean, and the copper apparently untouched. Lord Darnley informed me, that there never had been the slightest adhesion of either weed or shell-fish to her copper, but that a few small barnacles had once appeared on the loose oxide of iron in the neighbourhood of the protectors, which, however, were immediately and easily washed off. The Carnebrea Castle, a large vessel of upwards of 650 tons, was furnished with four protectors, two on the stern and two on the bow, equal together to about 1-104th of the surface of the copper. She had been protected more than twelve months, and had made the voyage to Calcutta and back. She came into the river perfectly bright; and when examined in the dry dock, was found entirely free from any adhesion, and offered a beautiful and almost polished surface; and there seemed to be no greater wear of copper than could be accounted for from mechanical causes.

"Had these vessels been at rest, I have no doubt there would have been adhesions, at least in Portsmouth or Sheerness harbours, where the water is constantly muddy, and where the smallest irregularity or roughness of surface, from

either wear, or the deposition of calcareous matter, or the formation of oxides or carbonates, enables the solid matter floating in the water to rest. There is a ship, the Howe, one of the largest in the navy, now lying at Sheerness, which was protected by a quantity of cast iron judged sufficient to save all her copper, nearly fifteen months ago. She has not been examined; but I expect and hope that the bottom will be covered with adhesions, which must be the case if her copper is not corroded: but notwithstanding this, whenever she is wanted for sea, it will only be necessary to put her into dock for a day or two, scrape her copper, and wash it with a small quantity of acidulous water, and she will be in the same state as if newly coppered.

"At Liverpool, as I am informed, several ships have been protected, and have returned after voyages to the West Indies, and even to the East Indies. The proportion of protecting metal in all of them has been beyond what I have recommended, 1-90th to 1-70th; yet two of them have been found perfectly clean, and with the copper untouched after voyages to Demerara; and another nearly in the same state, after two voyages to the same place. Two others have had their bottoms more or less covered with barnacles; but the preservation of the copper has been in all cases judged complete. The iron has been placed along the keel on both sides; and the barnacles, in cases where they have existed, have been generally upon the flat of the bottom; from which it may be concluded, that they adhered either to the oxide of iron, or the calcareous deposits occasioned by the excess of negative electricity.

"In the navy, the proportion adopted has been only 1-250th of cast iron, at least for vessels in actual service, and when the object is more cleanness than the preservation of the copper.

"It is very difficult to point out the circumstances which have rendered results, such as these mentioned with respect to Liverpool traders, so different under apparently the same circumstances, i. e. why ships should exhibit no adhesions or barnacles after two voyages, whilst on another ship, with the same quantity of protection, they should be found after a single voyage.* This may probably depend upon one ship having remained at rest in harbour longer than another, or having been becalmed for a short time in shallow seas, where ova of shell-fish, or young shell-fish, existed; or upon oxide of iron being formed, and not washed off, in consequence of calm weather, and which consolidating, was not afterwards separated in the voyage. From what I can learn, however, the chance of a certain degree of foulness, in consequence of the application of the full proportion of protecting metal, will not prevent ship-owners from employing this proportion, as the saving of copper is a very great object; and as long as the copper is sound, no danger is to be apprehended from worms.

"It ought to be kept in mind, that the larger a ship, the more the experiment is influenced by the imperfect conducting power of the sea water, and consequently the proportion of protecting metal may be larger without being in excess.

"I have mentioned these circumstances because they apply to ships already coppered, and because I have heard that a Liverpool ship, of which it was doubtful whether the copper was in a state such as would enable her to make another voyage to India with security, has, by the application of protectors of 1-70th, made this voyage,* without apparently any wear of her sheeting; and that she is now preparing with the same protectors to make another voyage.

"In cases when ships are to be newly sheathed, the experiments which have been detailed render it likely that the most advantageous way of applying protection will be under, and not over the copper: the electrical circuit being made in the sea water passing through the places of junction in the sheets; and in this way every sheet of copper may be provided with nails of iron or zinc, for protecting them to any extent required. By driving the nail into the wood through paper wetted with brine *above* the tarred paper, or felt, or any other substance that may be employed, the incipient action will be diminished; and there is this great advantage, that a considerable part of the metal will, if the protectors are placed in the centre of the sheet, be deposited and re-dissolved: so there is reason to believe that small masses of metal will act for a great length of time. Zinc, in consequence of its forming little or no insoluble compound in brine or sea water, will be preferable to iron for this purpose; and whether this metal or iron be used, the waste will be much less than if the metal was exposed on the outside: and all difficulties with respect to a proper situation in this last case are avoided.

"The copper used for sheathing should be the purest that can be obtained; and in being applied to the ship, its surface should be preserved as smooth and equable as possible: and

* The quality of the copper may be another cause.

* The Dorothy.

the nails used for fastening should likewise be of pure copper; and a little difference in their thickness and shape will easily compensate for their want of hardness.

"In vessels employed for steam navigation, the protecting metal can scarcely be in excess, as the rapid motion of these ships prevent the chance of any adhesions; and the wear of the copper, by proper protection, is diminished more than two-thirds."

ENGLISH GRAMMAR.

(*Continued from page* 357, *No.* 135.)

Of the Adverb.

We have already seen that the adjective is used to describe the quality of a noun; in a similar manner is the adverb employed to describe an adjective, a verb, or another adverb.

To describe an Adjective—As, Freemasonry is a *very* excellent institution; and if *truly* good men knew its object, they would not fail to become warm supporters of *so* benevolent an institution.—In this example the adverbs *very*, *truly*, and *so*, describe the adjectives *excellent*, *good*, and *benevolent*.

To describe a Verb—As, A good Mason (I wish there were a great many more of these) will *steadily* pursue the path of virtue, *firmly* rely upon the justice of Divine Providence, and *carefully* prepare for that event which puts the king and the peasant upon an equal footing.—Here the verbs *pursue*, *rely*, and *prepare*, are described by the adverbs *steadily*, *firmly*, and *carefully*.

To describe another Adverb—As, I *very* sincerely wish to see the genuine principles of this Order shine forth in the lives of its constituents; and I *most* fervently hope, that every man who enlists under its banner will consider himself *more* particularly called upon to sustain, without a blemish, the character of a faithful husband, an affectionate father, a true patriot, and a philanthropic friend of mankind.—The adverbs *very*, *most*, and *more*, are used in this example to describe other adverbs, *sincerely*, *fervently*, and *particularly*.

Adverbs take their name from *ad*, to, and *verbum*, a word; and are so called because they are commonly added to verbs, to show in what time, place, or manner; when, where, or how a thing is done.

There are about 2600 English words belonging to this part of speech, most of which end in *ly*.

Some further definition of adverbs may, perhaps, in this place be necessary, to enable the learner to distinguish them with facility.

They are used to express Number, as *once*, *twice*; Order, as *secondly*, *thirdly*, *finally*; Place, as *here*, *there*, *hence*, *backward*; Time, as *now*, *yesterday*, *to-day*; Quantity, as *much*, *sufficiently*; Manner or Quality, as *wisely*, *well*, *ill*, *foolishly*, *slowly*; Doubt, as *perhaps*, *possibly*; Affirmation, as *yes*, *certainly*; Negation, as *no*, *not*; Interrogation, as *how*, *why*, *wherefore*; Comparison, as *more*, *most*, *better*, &c.

Examples for Practice.

Thrice the briudled cat hath mew'd,
Twice and once the hedge-pig whin'd.

Thirdly and lastly, I shall conclude.—Here they come!—I wish I had been elsewhere, anywhere, nowhere, rather than here; for I have gambled away more money to-night than I shall get again during my whole life.—Be wise to-day, 'tis madness to defer.—Hereafter ye shall see the Son of Man coming in the clouds of heaven.—Henceforward I will lead a new life.

I never lov'd a tree or flower,
But 'twas the first to fade away.

He supplies the wants of man abundantly.—I acted foolishly, though not unjustly.—Perhaps I shall see you to-morrow.—Surely you are not in earnest?—Yes, I am indeed.—Nay, my good Sir.—How amiable she looks!—Wherefore should you destroy so much innocence?—I am almost ashamed to tell you, that I am less happy in my present situation.

I continue to be, Sir,

Yours, obediently,

W. Smith.

Castle-House Academy,
March, 1826.

MAGNETIZING POWER OF RAYS OF LIGHT.

Professor Morichini, of Rome, some time ago announced that he had succeeded in magnetizing a needle by exposing it to the violet ray of the solar spectrum; the experiment was repeated, without success, by Professor Configliachi at Pavia, and M. Berard at Montpellier; Doctor Brewster states, in his Treatise on New Philosophical Instruments, that Sir H. Davy and the late Professor Playfair witnessed a successful repetition of it in Italy; but, from the indistinct and contradictory results that had been obtained even in that country, it had been concluded that the experiment was still more unlikely to succeed in our own northern climate, and no further elucidation of the subject had been obtained.

The unusual clearness of the weather, however, last summer, induced Mrs. Somerville, the lady of Wm. Somerville, M.D., F.R.S., to institute some experiments on the subject, the results of which, as communicated by her husband to the Royal Society, are as follow:—

An equiangular prism of flint-glass being placed in an aperture in a window-shutter, a sewing needle, about an inch long, which had been previously ascertained to be devoid of magnetism by its attracting indifferently either pole of a magnetized needle,* was exposed to the violet ray of the spectrum, thrown on a pannel, at the distance of about five feet. One half of the needle was covered with paper, as the author did not deem it likely that polarity would ensue from the action of the light if the whole of the needle were uniformly exposed to its influence. In about two hours the needle became magnetized, the exposed end being found to the north pole. The experiment having been many times repeated with the violet ray, and always with success, the blue and green rays of the spectrum were next ascertained to produce a similar effect, but in a less degree, and the indigo ray in a degree nearly as great as the violet. The yellow, orange, and red rays had no effect whatever on the needles exposed to them, even when the experiments were continued for three successive days; nor was any magnetism developed by the calorific rays, which showed that heat had no share in causing the results.

Pieces of clock and watch-springs, about an inch and a half long, and from an eighth to a quarter of an inch in width, previously ascertained to be unmagnetic, or reduced to that state by heating them, were exposed in the same manner to the more refrangible rays, and they also were rendered magnetic, the exposed ends always becoming north poles. They appeared, indeed, to be more susceptible of magnetization than the needles, probably on account of their greater extent of surface and blue colour. Bodkins were not affected, owing, perhaps, to their greater mass. When the violet air was concentrated by means of the large lens employed by Dr. Wollaston in his experiments on the chemical rays, magnetism was imparted to steel in a shorter time than by that ray in its ordinary state.

It was found to be unnecessary to darken the room for these experiments, it being sufficient to throw the spectrum on a part of the room where the sun's rays did not shine.

Mrs. Somerville next tried the effect of the solar rays as transmitted by blue glass; and on needles being exposed, half covered as before, under glass coloured blue by cobalt, care being taken that no magnetic substance was present, they also were magnetized. It was not ascertained whether the rays which produce chemical charges had any share in this effect; for by subjecting two slips of paper, dipped in solution of muriate of silver, to the action of the sun's rays under the blue and under common white glass, both

* The magnetic needle employed for this purpose was also a sewing needle, which, after it had been magnetized in the usual way, was driven through a cork in which a glass cap was inserted; and it was then suspended, so as to revolve freely on the point of another sewing needle.

were blackened in the same time and to the same degree. Needles exposed in the same manner under green glass were also magnetized.

By enclosing needles in pieces of green and blue riband, half of each being covered with paper, and hanging them up in the sun for a day, behind a window-pane, they likewise acquired polarity; the exposed ends becoming north poles as usual. But no effect was produced, by the same treatment, on needles inclosed in red, orange, or yellow silk.

Throughout the experiments detailed in this paper, with a very few exceptions, seemingly attributable to a predisposition to magnetism too slight to be detected, the exposed end of the needle, &c. employed, became the north pole. From ten to twelve and one o'clock appeared to be the most favourable time for the experiments. As the season advanced, the magnetism acquired was less permanent, or the needle required exposure for a longer period to render it permanent, and the effect in general decreased. The author infers from the whole, that the more refrangible rays of light have the property of imparting magnetism.

FLAT ROOFS.

SIR,—About three years ago I built a summer-house, 18 feet diameter, with a flat roof, raised one inch in the centre. The joists were covered with three-quarter boards, planed on the under side for painting, and covered with stout old ship canvass, to allow the boards to swell and shrink. Canvass was tacked all round on the edge (end or side of boards), and hanging down half an inch below the boards. The canvass then had a coat of hot tar (one quarter pitch, to make it set quick, and prevent it running through the joists). It was next sanded, and left till the sand was either blown off or sunk: it then had a coating of hot tar only, and sanded. The following year it had another tarring and sanding, so that it had in all three coats, which were always laid on when the sun shone powerfully. It is perfectly tight, though played and skipped upon by my young ones and their friends at all times.

Wishing your useful publication every success,

I remain, Sir,
Your obedient servant,
RAMSGATE.

NOTICES TO CORRESPONDENTS.

We have in preparation for our next Number, an account of a new Gas Engine, invented by Mr. Chesterton; when we shall also give a description of Mr. Brunel's.

The Paper of Mr. Jones, if possible, in our next.

We have not come to a decision in regard to A. E.'s kind offer, and we are afraid of occupying too much of our space with the sort of matter in question. We shall see, however, whether we cannot avail ourselves, in a condensed form, of his useful observations.

Communications are received from—S. R. C.—Mentor—Lieut. H.—Mr. B.—Q. D.—W. H. W.—Clyde—A Member of the Dewsbury Mechanics' Institute—W. C.—Ansley—P. X.

*** *Part XXXIV., price One Shilling, is published this day, April 1st.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills, Jowett,* and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

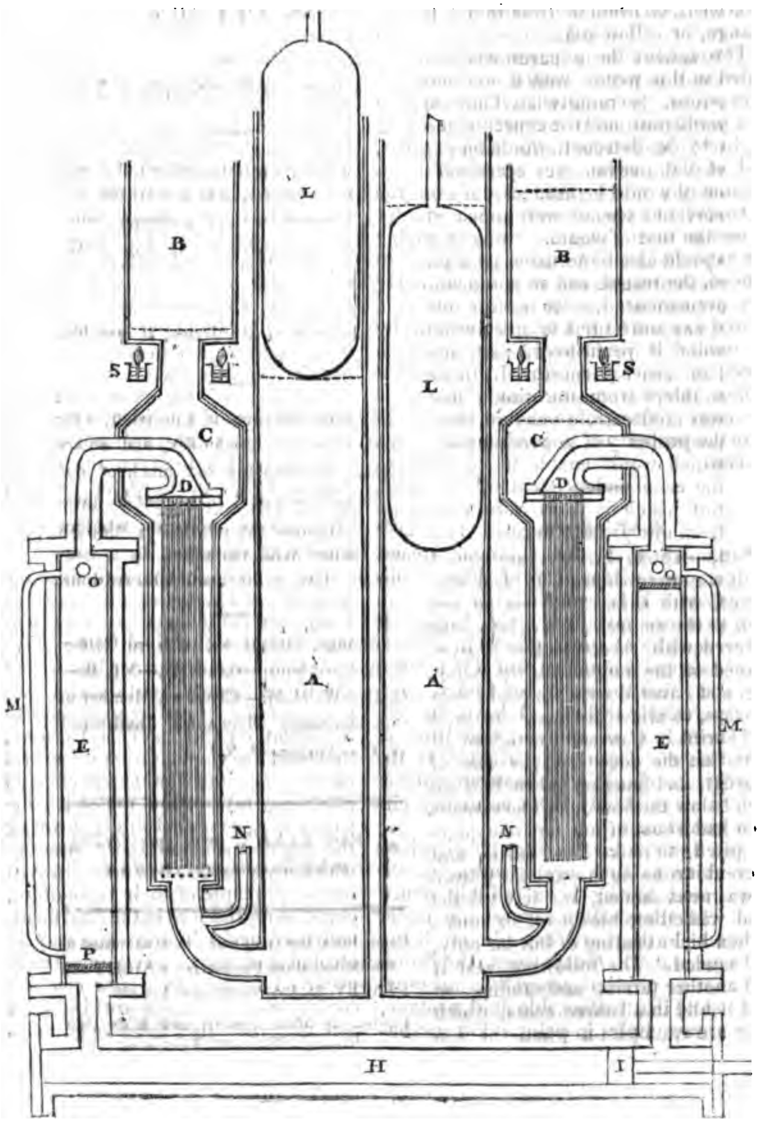
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 137.] SATURDAY, APRIL 8, 1826. [Price 3*d*.

NEW GAS POWER-ENGINE,

INVENTED BY MR. B. CHEVERTON.



NEW GAS POWER-ENGINE.

(To the Editor of the Mechanics' Magazine.)

SIR,—It has long been a desideratum in practical mechanics, to possess a power-engine which shall be ready for use at any time, capable of being put in motion without any extra consumption of means, and without a loss of time in its preparation. These qualities would make it applicable in cases where but a small power is wanted, and only occasionally required. They are so numerous, and the consequent saving of human strength would be so great, that the advantages accruing to society would be immense, if even the current expense were much greater than that of steam. Such an engine should also be actuated by a force so concentrated, and so compendiously appropriated, as to occupy but little space and be but of little weight, by which it would become applicable to locomotive purposes. If, in addition to this, the consumption of materials was moderate, we should then be in possession of a mechanical agent which would enable us to navigate the *ocean* independent of the wind, but which it is in vain to expect from our present means. It is well known that the common steam-engine satisfies none of these conditions. It is true that, on the high pressure principle, the important requisite of great power in a little compass is obtained, but it is not less true that the saving of fuel is comparatively trifling. I have, indeed, been long of opinion, that little of this effect can be attributed to the greater elasticity of the steam, and that it arises chiefly from accessory circumstances.

I was, a few years ago, led by these views to turn my attention to the gases, having been forcibly struck with the prodigious pressure under which they are capable of being generated. Gunpowder, the fulminating powders generally, but especially that remarkable fluid, azotane, are examples in point. For mechanical purposes, a gradual production of gas is of course to be adopted. The evolution of carbonic acid gas, by the action of sulphuric acid on the carbonates, was an obvious case. On making the necessary calculations, this, with many other means, were found to be too expensive, because the scheme embraced this principle—an *expenditure* of the gas. It became necessary, therefore, to take into consideration those substances which, after assuming the gaseous form, could be fixed again in the fluid state, such as alcohol, ether, turpentine, &c. These, besides boiling at a low temperature, have little specific caloric, and their vapours little latent heat. Dr. Cartwright's much-neglected engine was recollected, but the waste of costly articles was not perhaps sufficiently guarded against. The idea of a liquid body, as oil, intervening between the piston and the vapour, naturally suggested itself. This, however, is not altogether new, for it was acted upon in the old atmospheric steam-engines; but the circumstances of the case require a modification of the plan, since the object is not so much to cut off the communication between the elastic fluid and the condenser, as between it and the external air. For this purpose the whole cylinder must be filled with the oil.

I have no doubt that a good engine may be constructed on this plan, but it did not fully meet my views; it was, therefore, with no little pleasure that I read the paper laid before the Royal Society, containing an account of the experiments made by Sir Humphry Davy and Mr. Faraday, in which the condensation of several of the gases into liquids was effected at a temperature, and under a pressure within practical limits, proving thereby that some of those gases to which my attention had been directed on the principle of their *expenditure*, could be reproduced in the fluid form, and used again in the same way as alcohol and ether. It immediately occurred to me, as a *sine qua non* condition of an engine working with *such* materials, that there be no mov-

ing joint to which the gas can have access; in short, that there must not be a possibility of its escape, and that the simplest and most obvious means of satisfying this condition, was to make the same vessel alternately a boiler and a condenser. Further consideration confirmed me in the idea of the practicability of this plan, since the difference of temperature required to produce a great difference in the elastic force of the gas is but a few degrees when the minimum elasticity is already considerable. The project of an engine, as represented in the figure prefixed, was therefore substantially completed; it remained only to adopt a mode of alternately heating and cooling the liquid employed. Several plans suggested themselves, but I prefer, for its simplicity, its certainty, and the ease with which it can be regulated, the method which will be immediately explained.

Description of the Engine.

The figure presents a vertical section; with this remark, that as all the vessels have a circular form, an horizontal section becomes unnecessary. It is proper to observe, that the disposition of the parts as represented, has been adopted solely for the purpose of bringing the whole into one view. The engine consists of a duplication of parts, viz.—

AA, two refrigerators, containing cold water.

BB, calorators, containing hot oil.

CC, alterniators lined with wood, and filled alternately with the hot and cold medium.

DD, generators, consisting of a cylindrical assemblage of capillary copper tubes, about half filled, at the minimum pressure, with the carbonic acid, or other liquid employed—they communicate with the upper end of

EE, strong copper gasometers, lined with wood, nearly full of oil, at the minimum elasticity of the gas, but which, at its maximum, expels nearly the whole of it into the

H, cylinder, in which works I, the piston.

LL, solid wooden plungers.

MM, capillary glass tubes, for observing the movements of the oil, aud fixed in a particular manner—they are not absolutely necessary.

NN, pipes for a constant supply of cold water.

OO, pipes through which gas is in the first instance introduced, and oil occasionally injected, in order to supply the waste at the piston rod—they are closed in a particular manner.

OP, boards floating on the oil.

SS, circular cisterns containing oil, each having a circular row of lamps; (- - - - -), level of the water and of the oil; (. . . . .), level of the separation between the water and the oil.

Action of the Engine.

One of the gasometers being nearly full of oil, and the generator attached to it, with the liquid contained therein, being reduced to the lower temperature, the elasticity of the gas is then at its minimum; but which will at all times be very considerable, especially if the carbonic acid, or the nitrous oxide, are the liquids employed; a flood of hot oil suddenly descends upon and surrounds the generator; instantly an evolution of gas takes place, and continues till its density, and consequent elasticity, produces the pressure under which the liquid ceases to boil at the temperature to which it has attained. This increase in the elastic force of the gas will be in some proportion to the elevation of temperature, but differs, not only with the different liquids employed, but with the same liquid, according to the prior pressure under which it was placed. Meanwhile, the gas pressing on the oil in the gasometer, causes it to rush into the cylinder, carrying with it the piston that works therein to the further extremity. The duplication of the apparatus produces the return stroke, and thus an alternate movement is kept up. But to effect the re-action, the elasticity of the gas, which now occupies nearly the whole of the gasometer, must be reduced. For this purpose, the generator is flooded with cold water, which rises from below, bearing up the hot oil

on its surface to the place from which it descended. The temperature of the generator and its liquid falls, the gas condenses rapidly on its extensive surface; its density as rapidly diminishes, it returns to its first elasticity, and the oil regains its former level in the gasometer. Again the water sinks, and the hot oil descends, and thus the same vessel becomes alternately a boiler and a condenser; in one case generating a gas, in the other a liquid.

To force up the hot oil from the alternator into the calorator, in which it is heated, a plunger is immersed in the column of cold water contained in the refrigerator; this raises its level, and consequently the level of the column of water and oil with which it is in equilibrium. There is not the friction, concussion, or elaborate workmanship, which would attend a piston employed for this purpose. The specific gravity of the oil being less than that of water, there will of course be a difference and a varying difference in the altitude of the two columns when in equilibrium, according to well-known hydrostatic principles, but this is of no consequence. The plunger must be so proportioned, and immersed so deep, as to displace a body of water equal in volume to that of the oil elevated, besides what is required for the raising of its own level. Now it is obvious that here is an opportunity to regulate the power of the engine, for the less the plunger is raised the less is the descent of the hot oil, and consequently less of the liquid is exposed to its influence; a governor, therefore, would be very properly applied to the movements of the plungers. If a greater power is required than when the governor is at the extreme limit of its influence, that is, when the generator is entirely surrounded with hot oil, it may be produced by bringing the lamps nearer to the calorator, or by lighting a greater number of them. If, however, the same velocity of action is not required to be maintained, the engine, possessing in itself a source of self-regulation, will increase in energy for the occasion; because the slowness of the strokes, allowing a longer time for the heating of the liquid, its temperature will be raised to more than the ordinary degree, for this must be always less than that of the hot oil. The extent to which this enlargement of the power may be carried, and the facility with which it may be effected, is of great importance with respect to navigation, and will be duly appreciated by those conversant with the subject. The limits of this extension, and the safety of the engine, are points which will be discussed hereafter. It should be observed, that the action of the plungers must be a little in advance of that of the piston, in order to give time for the heating and cooling of the *metal* of the generator.

Remarks.

There is this peculiarity in the engine, that it has neither valves, cocks, nor pumps, nor any moving joint, except that of the piston and its rod; hence its simplicity, and consequently the cheapness with which it may be constructed. The room which an eighty-horse power engine would occupy, would not probably be more than a cubical space of seven feet dimensions, so far as the cylinder and its appendages are concerned. It would be quite practicable to attach a gauge to the engine, by which the pressure of the gas may be ascertained; and means are devised by which the height of the liquid in the generator may be known. The introduction of the carbonic acid, or other liquid employed, should be in the form of gas. For this purpose, the generator must be brought to a lower temperature than the gasometer, which will occasion the greater part to condense therein; that which may form in the gasometer will distil over, after the apparatus for producing the gas is removed. It is also for this reason, that there is no fear an accumulation of the liquid will take place in that vessel during the working of the engine. To prevent condensation, however, in any hurtful degree, its interior is lined with wood, and a board floats on the sur-

face of the oil. Another plan would be, to maintain the gasometer at the higher temperature to which the liquid is raised; but this is by no means advisable if it can be avoided. The board is also of important use, in preventing the absorption of gas by the oil, during the greater pressure; which being evolved at the time of the collapse, would prove injurious, by diminishing the difference between the elastic forces. Oil is selected as the heating medium, because it is lighter than water, and has its boiling point so much higher. It is probable, however, that 212 degrees is a temperature sufficiently superior to that to which the liquid will require to be raised, and such as will produce its almost instantaneous heating; if so, hot and cold water may be employed. From the relative position of the two mediums, little communication of heat can take place. The alternator is internally lined with wood, partly to prevent a loss of heat, but principally to preserve, as much as possible, the coldness of the water. In a locomotive engine, the water could only be occasionally changed; in the intervals, a cooling process may be at work, and the plungers would perform the office of a pump.

I am, Sir,
Yours respectfully,
BENJ. CHEVERTON.

Kingsdown, Bristol.

MR. M'ADAM.

SIR,—The complaint of a Hertfordshire Farmer, respecting his wagons and hay-carts, may be very good, and I hope he will be able, one way or the other, to find a remedy. Had he confined his remarks to what he understood, I should not have felt myself called upon to trouble you with this letter, and, as the subject may not be so very interesting to your numerous readers, I will condense my remarks as much as possible.

The Farmer, in the course of his letter, takes an opportunity to abuse the roads, by proclaiming them vile and full of holes: this is not a fact; for the roads in this country are as good as need to be, and can vie with any in the world. I speak now of the high-ways; of the by-ways I shall be silent; they are, perhaps, a disgrace to those who ought to keep them in order, and it is of these, mayhap, that the Farmer complains, for nothing is so difficult as to make the owners of private roads keep them in good condition—the wranglings and disputations about them are eternal.

The Farmer then charges Mr. M'Adam, or his plan, with these faults—he, forsooth, is to be the 'scape-goat. This is exceedingly unfair; and here he shows his cloven foot. Why should he attack Mr. M'Adam, whose plan of making and mending roads has so decided a superiority over any other? The attack is unjust, and highly ungenerous—it is a wanton and unprovoked one, for I am sure no one has more claims on the thanks of the farmers than Mr. M'Adam, who has wrought so wonderful a change for the better in the country-roads of England. I myself can bear witness to it, and am of opinion that the farmers, coach-proprietors, and travellers should erect to Mr. M'Adam a colossal statue of Scotch granite, expressive of their thanks to him for the benefits he has conferred on them in general.

I hope the Hertfordshire Farmer, in future, will rein his pen, and not give it up to evil writing.

With my best wishes for your success,

I remain, Sir,
Your constant reader,
VIATOR.

March 31st, 1826.

VAUGHAN'S STEAM ENGINE.

SIR,—Can Mr. Vaughan's friends be so infatuated as to consider an article in the Mechanics' Magazine unworthy their notice? or are they convinced of the real merit of his alteration in the form of the steam-

engine? or, in other words, have they found out that alteration to be any thing but an improvement?

The description I gave of the engine* (the correctness of which neither Mr. Vaughan nor his friends can call in question) will sufficiently convince every man who understands the principles of steam-engines of its defects, but the *users* of them may still be doubtful; and, perhaps, no reasoning could convince a man of their inferiority who does not understand the action of these machines. But I would ask Mr. Vaughan upon what grounds he asserts their superiority? and what proof he can bring of it? I shall not be satisfied with being told they turn so many grinding-stones with so much coal, because every mechanic knows this sort of work opposes a resistance which it is very difficult if not impossible to estimate, but the quantity of coal required to do a certain quantity of some sort of work which can be fairly measured; and I assure Mr. Vaughan, if he can thus *prove* their superiority, he shall not find for them a warmer advocate than,

Sir,

Your humble servant,

S— Y—,

A Young Engineer.

IMPROVEMENT OF THE LONDON PAVEMENT.

[From an intelligent and judicious pamphlet which Colonel Macirone has just published, under the modest title of "Hints to Paviors."]

My expedient is pressure, which may be applied in three different stages of the work; first, to harden the ground previously to laying the stones; secondly, to fix and depress them when laid; thirdly, to equalize and perfect a pavement after it has been some time in use, by applying the pressure only on the protuberant parts.

The machine I propose for the above purpose is similar to a pile-driver of the lesser kind; the weight being drawn up by a rope passing over a single pulley wheel at the top of the slide shafts, and terminating on the other side in a cluster of smaller ropes or cords, one for each of the six, eight, or ten men employed to work the machine. The weight, or "monkey," as I believe it is called, is raised by simultaneous hauls of the men, and let fall again by similar alternating movements of relaxation. For my purpose, the weight should be of wood, more or less conical, with a flat circular base of about three feet diameter. A solid block of oak, well bound and shod with wrought iron, and weighing about 5 cwt., would produce sufficient force with very little raising, consequently with much rapidity, and be at the same time perfectly manageable. The perpendicular slide shaft and stays, together with the weight, that is to say, the whole of this simple machine, is to be fixed upon a quadrangular frame of about eight feet by five; and to this frame I would attach four or six pivot or castor wheels of about a foot diameter, by which it might be moved with the greatest ease in every possible direction. If the men who work the weight are made to stand upon the frame itself, it may be worked uninterruptedly, while it is regularly drawn over the pavement, faster or slower, repeating or not repeating the blow on the same spot, according to the intention and discretion of the superintendant.

It surely must be allowed, that the present method of simply digging up the ground to a considerable depth with a pickaxe, without any subsequent hardening, can but furnish the stones with a foundation of very unequal resistance. It is true, that, after laying them in this soft bed, they are slightly compressed with a hand rammer; but it is obvious, that unless this compression be made equal to that which the stones will afterwards have to endure from carts, &c. the surface of the pavement must speedily give way, and become the

* Vol. v. page 171.

counterpart of the unequally dense substratum. Even were the subjacent earth quite uniform in its density, or rather softness, I should say, it is absurd to expect the pavement can preserve its level, when that density is so far from being sufficient to resist the maximum of pressure it is destined subsequently to endure. Were this subsequent pressure equally distributed, and applied to every stone, we might then expect the whole surface to sink together; but as this can never be the case, inequality of pressure will speedily produce inequalities of the surface, which must increase in a rapid geometrical ratio. To establish a permanently level pavement with the materials we are speaking of, I do not say that the subjacent earth must be of a perfectly homogeneous density; it is sufficient that it be so compressed, either before or after laying the stones, or both before and after, that its parts of minimum density be able to resist the maximum of the pressure it will be subsequently liable to. In laying a new pavement, I should advise, first, moderately to compress the earth, and afterwards repeat the ramming on the stones; by which division of the operation a degree of density will be obtained, with the application of much less power than would be required to produce the same by only one application on the surface of the pavement. If at this period the proper quantum of compression has been given, there is no fear of any inequalities being formed by the action of the heaviest vehicles; but I should not think it requisite to give a similar density to the pavement in every street, there being many through which a vehicle heavier than a coach is seldom, if ever, known to pass.

In cases where a street has been already paved in the usual way, and when, as is usual in a few days, it has begun to assume its wonted picturesque unevenness of surface, it may be rendered perfectly and permanently level, without the expense of taking up the stones, by the careful application of the machine I recommend. But the operation must not be too long delayed, for inequalities once formed, must necessarily increase with accelerated rapidity, inasmuch as the wheels continue to fall into the depressions with a momentum, which progressively increases with the increase of the depressions. An early obliteration of the nacent protuberances will put a stop to the evil, and a permanent density be established.

The exact state of the surface of the pavement is rendered remarkably evident and definable when water is thrown upon it; which I have had particular occasion to remark, when it has been applied abundantly to lay the dust. This I would make ancillary to the after-compressing operation I am now speaking of. The water-throwers should precede the machine, and certain men, with a good and careful eye, might mark the projecting stones with chalk, as a further guide to the action of the compressor. It is also probable that the water would, more or less, diminish the friction of the stones against each other, and facilitate their descent. I have frequently observed, that nearly one half of Piccadilly might be levelled in this manner, without the necessity of taking up a stone, except in a very few places, where extraordinary depressions have been formed. I do not, however, wish to establish the utility of the method I propose on the merits of this second-hand application of it, but mainly upon its application under and upon the stones, at the time of laying them. Nothing else will produce a level and permanent pavement with the materials at present in use, and consequently without increase of expense. With regard to the improvement of these materials, it is certain that the more exactly the stones are cut, the better; but this I apprehend must be regulated by the prescribed latitude of expense; it would be well to take off their convexity, by a few good chips from the top or crown of the stones that are much worn. But let them be wrought with the most mathematical nicety, it will avail no-

thing in the end, if they are laid according to the soft, uncompressed method of the London paviors. If we would have an even pavement, we must either have recourse to the deep beds of cement, or the huge stones I have described in the beginning of this article, with all their expensiveness and other inconveniences; or we must apply, to the method and materials already in use, the only process which will remedy their evident defects, and produce the wished-for result. As to the earth in which the stones are laid, I should prefer a mixture of broken gravel, dry rubbish, and a little chalk; but this arrangement also must depend on the expense. The quantity of oxide and carburet of iron which forms under the pavement, produces a strong tendency in the subjacent mass to indurate and agglomerate, which would be very greatly accelerated by the pressure I recommend.*

It now only remains for me to refer to the principal or only objection which I can anticipate might be made to the use of my machine; which is, the supposed injury it might occasion to the gas and water pipes. It will be very easy to prove in half an hour, by experiment, that no such injury can occur. Cast iron pipes, at the depth of two feet, would not sustain any injury from the utmost efforts of the engine, especially if any care had been taken to lay the finer portion of the earth or gravel in immediate contact with them. But this precaution, I affirm, will be by no means necessary, if the pipes are from two to three feet from the surface, which surely is not an unreasonable depth.

* I have frequently had occasion to remark the very great degree of hardness which most earths will acquire, when submitted to pressure, after being saturated with animal or oleaginous fluids. *En passant*, I submit, whether some such use might not be made of the broth from the huge cauldrons at Whitechapel, wherein many horses are boiled at a time for dog's-meat.

NEW WEIGHTS AND MEASURES.

(To the Editor of the Mechanics' Magazine.)

Sir,—I read lately, in a provincial Paper, a letter on the New Standard Weights and Measures, and was so well pleased with it as to wish earnestly that it should have more than a mere local circulation; I therefore send you a copy of it, in the hope that you may deem it worthy of a place in the Mechanics' Magazine, and thus make it known to all the world.

I remain, Sir,

Your obedient servant,

Philo-Mechanicus.

April 1st, 1826.

Mr. Editor,—With your permission, I beg leave to offer some observations on the subject matter of weights and measures, ordered by the New Act.

In the first clause of this Act we learn that the straight line, or distance, between the centres of the two points in the gold studs in the straight brass rod, now in the custody of the Clerk of the House of Commons, whereon the words and figures "Standard Yard, 1760," are engraved, shall be the original and genuine standard of that measure of length or lineal extension called a yard, and is hereby denominated the imperial standard yard, wherefrom or whereby all other measures of extension whatsoever, whether the same be lineal, superficial, or solid, shall be divided.

Again, the fourth clause of this Act declares that there is now, in the custody of the Clerk of the House of Commons, a brass weight, called a pound troy weight, made in the year 1758, and that such brass weight shall be, by this Act, the imperial standard troy pound, and declared to be the unit or only standard measure of weight, from which all other weights shall be derived, computed, and ascertained; and that this impe-

rial pound contains 5760 grains, and that 7000 such grains shall be declared to be the pound avoirdupois. Now, we have no reason to suppose otherwise, but that that these respective number of grains constituted the pound troy and the pound avoirdupois ever since the year 1758, and that, consequently, this New Act makes no change at all in these respective weights, certainly not in their multiples or submultiples.

Having gone thus far with these two clauses, it does not appear in what manner the distance between the centres of the two points in the said straight brass rod was ascertained, or how the brass standard became of such a magnitude, so fixed upon, as to constitute the troy pound. It might not be amiss, then, I presume, to see whether any dependence can be placed on these several measures of extension and weight, and the only clue we have for this purpose is, to pay attention to the third and fifth clauses of this Act, by which, I think, the matter in both points may be effected; and if the mode I shall adopt for the attainment of this object be in any particular exceptionable, I shall feel obliged to any one of your scientific Correspondents to point it out and set me right. But before I detail the mode of procedure, I do not think that I shall run the risk of the chance of incurring the imputation of arrogance or vanity, when I aver that no person can resort to better resources for the purpose than myself, for I possess a most accurate astronomical circle, of the first class, made by the incomparable mechanist Mr. Troughton, accompanied with a transit clock of extraordinary workmanship, to which is attached Mr. Troughton's excellent tubular pendulum. By these instruments time may be ascertained to the nicest precision.

I cannot refrain, in this place, from noticing what is expressed in the third clause of this Act, which indeed is the *primum mobile* of my experiment, and the *data* upon which I establish it. This clause asserts that the imperial standard yard is in the proportion to the length of the pendulum, vibrating seconds of mean time in the latitude of London as 36 inches to 39·1393 inches. I consider this as premature; for I would ask what inches, and whence are they gotten? This is a sort of *petitio principii*, as logicians term it, a begging the question, a precarious supposing a thing to be true which is uncertain, and which it behoves the disputant to prove. It is necessary, then, to determine the measure or extent of an inch, concerning which we have no directions in the Act, but only the bare mention that 39·1393 inches constitute the length of the pendulum which vibrates seconds of mean time in the latitude of London.

In my experiment I did not proceed with such precision as a certain Captain, who would make us believe that he divided the diameter of the finest hair from a lady's head into one hundred thousand equal parts. Nor have I deemed it absolutely necessary to attend to the latitude of the place, for the difference of the length of the pendulum which vibrates seconds at the equator, and that at the pole, is only 17 hundredths of an inch. I was satisfied with coming to the truth within the tenth of an inch, taking the extension of an inch according to the idea we have of it at present, for it is this very extension that I am about to ascertain. The word is derived from the Saxon *ince*, the twelfth part of a foot. Having premised thus much, which may not be considered as a digression, but as a sort of a preliminary, I come now to my experiment, in describing which, to prevent confusion, I shall use the terms foot, inch, and their plurals, feet, inches.

Having procured a thin slip of rolled brass, of about an eighth of an inch thick, and about an inch wide, preserving equal thickness and width throughout, to the extent of at least five feet, made perfectly straight. At the middle of the breadth of one end, a small hole was drilled, and the rod put to suspend from this hole on a fine steel pin, fixed conveniently as near the transit

clock as possible, where the rod could vibrate freely small arcs. The pendulum of the clock being adjusted to vibrate seconds of mean time precisely, the rod was shortened, gradatim, till it vibrated equally with the pendulum, or, technically speaking, isocronically with it. Now, having obtained a bar, or rod, of homogeneous texture, and of equal breadth and thickness, which, being suspended at one end of it, vibrated small arcs in equal times, and these equal times were seconds of mean time, my main object was accomplished; for nothing remained for me to do, but to find the centre of oscillation of this rod. It would be pedantic in me, and superfluous, in this place, to investigate this centre by a fluxional process, when its distance is so well known to your mathematical readers; suffice it to say, that it is exactly at two-thirds of the whole length of this rod. The next procedure was, to divide the rod exactly into three equal parts; two of these parts constituted the length of the pendulum, which vibrates seconds of mean time. Now, the third clause of the New Act becomes necessary, and this is the main purport of its enactment. For, if our standard yard was lost, or annihilated, we have upon record, that, if the length of the pendulum, vibrating seconds of mean time, be divided into 391393 equal parts, that 36,000 of such equal parts shall constitute the imperial standard yard. Deeming it sufficient, I only divided the distance from the point of suspension to the centre of oscillation of my rod in 391 equal parts, and took 360 of those equal parts for the length of my yard, and it was astonishing how consistent the measure was with my gauging-rod. Taking 120 of these equal parts, the foot was determined, and ten of these parts, the inch was determined and its tenth. I hope I have explained the subject thus far satisfactorily to your general readers. I have only to observe here, that nearly, by a similar method to mine, Sir G. Shuckburgh obtained the length of his standard to be 39·1386; General Roy's 39·13717, and Bird's 39·13842. I would ask in this place, supposing our present yard was absolutely lost (but God forbid such Gothicism should ever take place in this our enlightened and highly favoured island), I say, I would ask, whether such precision would be required for common purposes in our various walks of life, to restore the extent of the yard nearer than one-tenth of an inch of the truth? For, after all our nicest experiments, carried on with every precaution the most minute philosopher can figure to himself, there will result a discrepancy in despite of every energy of his gifted and enlarged mind.

Having ascertained the measure or extent of the inch, it will remain only for me to point out the method for ascertaining whether the standard pound, now in the custody of the Clerk of the House of Commons, be correct. We must, now, for this purpose, have recourse to the record in the fifth clause of the Act, where it is said, that a cubic inch of distilled water weighs 252·458 grains. And in the fourth clause, that there are 7000 grains in a pound avoirdupois. And, again, in the sixth clause, it is asserted, that the gallon shall contain ten pounds avoirdupois weight of distilled water. Therefore, by analogy, as 252·458 grains : 1 cubic inch : : 70000, grains in 10 pounds : 277·274 cubic inches in the imperial standard gallon, to be the unit and only standard measure of capacity. Having now the solidity of the gallon given, as also the true length of the inch, a gallon measure can be made to any given diameter or depth at pleasure, if its form be wished to be cylindrical. Let us suppose $d =$ to any diameter fixed upon, *ad libitum*, and $h =$ to any depth fixed upon, so arbitrarily,

then, we have $d = \sqrt{\frac{277 \cdot 274}{\cdot 7854\ h}}$, and

$h = \frac{277 \cdot 274}{\cdot 7854\ d^2}$. If we take 9 inches for the gallon's diameter within, then the value of h will be 4·35 inches, nearly. Or if we would have the cylindrical gallon look more seemly, let its internal diameter be 7·2 then

h—6·81 inches, the depth. A gallon being made of these dimensions, which any tinman can perform with the greatest facility, and filled with rain water, the weight of this is 10 pounds avoirdupois, which may readily be divided into ten equal parts, using a good scale and small shot; and thus the true pound avoirdupois may be determined sufficiently accurate, and consequently the pound troy.

In conclusion, I would observe, that it would be to no good purpose for any one to attempt such an experiment as this, without being provided with a good transit telescope and astronomical clock.

I remain, Sir,
Your obliged servant,
FELIX FORD.

March 1st, 1826.

PREVENTION OF FIRE ON BOARD STEAM-PACKETS.

SIR,—As you were so kind as to give my "Hints to prevent the Extension of Fires" a place in your useful Magazine, I beg to offer another communication on a similar subject, namely, the Extinction of Fire on board of Steam-packets.

It appears to me, that it would be a matter easy of accomplishment to fix a pump in the side of each vessel, parallel with the fence which goes round it; for instance, it might be placed near where the cooking is done, and in fresh water would be found very useful. But the main thing I propose is, to have always ready such an apparatus as I have described in Number 103 of the Mechanics' Magazine, to be fixed on in case of fire. The water to supply it would, of course, always be at command; and, I should think, there would be no want of hands to work it. The pump need not extend deeper than two or three feet below the surface of the water; and the bottom, which receives the bucket or sucker, should be closed like a box, only there must be a few small holes bored in it to admit the water, as I think it may be likely to put it out of repair, if two large a body is permitted to rush in. If the motion of the water shall be found to force up the bucket of the pump, when not in use, the handle may be fastened down by means of a staple fixed in the wood-work, with a hook hanging to it, such as is used in the country to prevent casements blowing to and fro with the wind. This may be made to put on the lower part of the handle and take off again, as occasion requires.

I would recommend, that in steam-vessels of a large description there should be two pumps, placed diagonally, one in the fore part, on one side, and the other aft, on the other; this will make "assurance doubly sure," and the hose-pipes will not be required so long, which will lessen the expense. I should think the cost for each pump need not exceed five pounds, which will be but a trifle, when compared with the safety each passenger and person on board will feel themselves in; as it will be obvious to every one, that if any accident happens from the fire, it cannot fail being extinguished in a few minutes. It will be much easier, likewise, for those employed in filling the casks for a voyage with fresh water, and more preferable than the present method of dipping with buckets,* which can hardly fail to take up filthy substances, which are always more or less floating on the surface.

I remain, Sir,
Your most obedient servant,
A— S—.

Margaret-street, Cavendish-square.

* When the Regent steam-packet, which was burnt a few years ago, off Sheerness, first took fire, it was said, that the men who went to dip up water to extinguish it, lost their hold of the buckets in their hurry, otherwise the vessel would have been saved. The above plan does away with the liability to such a misfortune.

ADHESION OF GLUE AND SEALING-WAX.

SIR,—I send you the result of some experiments made by me to ascertain the force of *adhesion of common glue*. I need not observe that, on this subject, many circumstances must concur to produce a uniform result; such as the quality of the glue, the length of time it has been applied, and the degree of moisture in the atmosphere and probably temperature as well as nature of the substance to which it is applied; but, as an approximating result may be interesting to some of your readers, I beg to offer the mean of four experiments on the adhesion of glue when applied to dry deal and hazlewood, about 24 hours after the substances were glued together.

The smallest force required to separate the surfaces of a square inch I found to be 232 pounds, and the greatest force 560 pounds, and the medium of four experiments 340 pounds; I also tried the force of adhesion of the *best red sealing-wax*, and found it more than 1500 pounds per square inch, and of black sealing-wax to exceed 1000 pounds per square inch.

Amongst your numerous readers there are, doubtless, some who could, if they were disposed, oblige the public with the results of similar experiments on other cements used in the various arts, and thereby spread a knowledge of some of the most useful properties of matter, and probably lead to considerable improvements. I cannot help thinking, that much greater benefits would be derived from a general communication of matters of fact, than in following that absurd phantom, called perpetual motion, which, I observe, occasionally occupies a page or two of your valuable Magazine.

I am, Sir,

Your obedient servant,

B. BEVAN.

P.S. The concise method of correcting the dead reckoning, given in page 343, might also have been given in other terms more convenient for those who have only the more common book of logarithms, with the sines, tangents, &c. without the secants; thus, from the logarithm of the sum of the departures, subtract the logarithmic cosine of the middle latitude, the remainder will be the logarithm of the difference of longitude.

Thus, in the example given, the logarithm of 316 =	2.49969
Deduct the logarithmic cosine, 39° 3′ - -	9.89020
Logarithm of 407 minutes nearly - -	2.60949

AFRICAN MANUFACTURES.

A cotton shawl, manufactured by Africans from the growth of their own country, has been received at Baltimore. It consists of five pieces, woven three yards in length, and six inches in width, sown together, and is considered a favourable specimen of arts yet in their infancy amongst that rude people. Cotton, of the quality of which this shawl is manufactured, is said to grow in abundance over a tract of country extending to 40 degrees of latitude, and 51 or 70 of longitude, inhabited by many millions of naked human beings.

RAPID ORAL COMMUNICATION.

In the last Number of the Revue Encyclopedique, which has just arrived in this country, there is an account of a very extraordinary proposal, viz. to communicate verbal intelligence, in a few moments, to vast distances; and this not by symbols, as in the telegraph, but in distinct articulate sounds, uttered by the human voice. It is deserving attention that this plan originated with an Englishman, Mr. Dick; according to whose experiments the human voice may be made intelligible at the distance of twenty-five or thirty miles.

The experiments of M. Biot, the distinguished French mathematician and philosopher, have ascertained that sound travels ten times quicker when transmitted by solid bodies or through tubes, than when it passes through the open air. At the distance of 476 toises, or more than half a mile, the low voice of a man was distinctly heard.

At the latter end of the last century, a clergyman, named Gautier, conceived a plan of transmitting articulate sounds to immense distances: he proposed the construction of horizontal tunnels, that should widen at the extremities, by means of which the ticking of a watch might be heard more distinctly at the distance of twenty-six hundred feet than when placed close to the ear. He calculated that a succession of such tunnels would transmit a verbal message nine hundred miles in an hour.

Those persons who are in the habit of ridiculing whatever is proposed beyond the range of their former limited experience, would do well to recollect that lighting our streets with smoke, or coal-gas, and travelling by steam, would have been deemed the most extravagant proposals by our ancestors; and the man who had ventured to assert their possibility would have been thought deserving a place in Bedlam.

With respect to the transmission of sound by tubes, it has long been practised, on a small scale, in extensive warehouses and workshops, to communicate the order of the counting-house to distant parts of the building. The plan mentioned in the Revue Encyclopedique may be regarded as an extension of the same principle to a kingdom.

ELECTRICITY AND MAGNETISM.

SIR,—I shall be obliged if any of your scientific Correspondents can inform me whether it is possible to communicate magnetism to a piece of steel wire, by means of a large electrical battery, without making use of a helix. I am inclined to think not, for this reason:—I passed the shock of four jars (that would contain about one quart of water each) along a needle, from end to end, but without success; I then sent the charge across the needle, between the eye and the point, but did not succeed. I then placed the needle in the bore of a piece of glass tube, and hermetically sealed it at each end; upon placing the whole in the helix, and sending the charge of *three* of the jars along it, I found it had become a complete magnet. The needle weighed one grain and a half, and it would sustain a weight of eight grains and a half.

If any of your Correspondents will inform me whether there is any theory (which there undoubtedly is) to account for these phenomena, and what it is, they will oblige me much.

I will, upon some future occasion, transmit to you a short list of experiments illustrative of the general principles of electricity, should you deem it worthy of your attention.

I remain, Sir,
Your obedient servant,
H. R. W.

DOUGLAS'S PATENT HYDRAULIC INK-STANDS.

SIR,—I have now had in use, for some months, one of Douglas's Patent Hydraulic Ink-stands, for which I paid three guineas. Nothing, as you are in all probability aware, can exceed the simplicity of the

construction, or the certainty with which you procure limpid ink from it; but here, I fear, end its advantages, as all that I have written with it promises to leave me shortly, without a trace behind—a conclusion that would be apt enough in regard to bills too punctually delivered, but tells strongly against an interminable work in folio, which I am preparing for the press.

Captivated, as I said before, with its simplicity, and the ease with which it complies with all my wishes in regard to mud and mould, I have struggled hard against this disadvantage; but, finding that no ink that I can procure is black enough to resist such potent filtration, I have hoped, despairingly, that one of your readers might possess, perhaps, a recipe that would.

It is not impossible that, when the cotton becomes thoroughly saturated with sediment, the ink that flows through it may be less ghastly. But independently of the mischief that may be done whilst waiting for such a result, shall we not lose in quantity what we gain in quality by it?

Mr. Douglas should be prepared for these difficulties, as he charges for his ink-stands as if they were faultless, and he resolved to make a fortune.

I remain, Sir,

Your obedient servant,

W— W—.

ANOTHER CALCULATING BOY.

On Wednesday evening last, we had the pleasure of being present at a preliminary examination, at the Gothic Hall, Piccadilly, of a child named George Noakes, who is about to exhibit his arithmetical powers to public admiration. He is certainly a great wonder; more so, perhaps, than either Bidder or Colburn (who, by the by, is said to have lost entirely the faculty by which he was distinguished in early life). He is not yet seven years of age, but solves all sorts of arithmetical questions with the greatest promptitude and correctness. Nor has he acquired this faculty through any system of training whatever — it has burst forth, as it were, all at once. He is the son of a poor labourer, and may be said to have been quite neglected in point of education. Among other questions, he was asked how many pinches of snuff a person would take in the course of a year, supposing he took thirteen every quarter of an hour? He answered almost immediately, 6,832,800. The question which puzzled him most was the following:—There are two numbers whose united amount is 240, and the difference between them 52—what are they? He gave the numbers at last correctly (94 and 146), but not till after repeated trials. Probably it was owing to the question being one which required more of a *reasoning* process than any of the others, that he found it so difficult. We wish him every success.

THE LITTLE WORLD.

A few twigs, full of sap, were placed in a small quantity of water for several days, until a part of the sap became incorporated with the water. A drop of this water was put on the head of a large pin, and, by the solar microscope, it was found to contain more than thirty thousand living creatures! — *Matthews on Sound, &c.*

POCKET ELECTRICAL APPARATUS.

Sir,—If Galvanus (who describes a small pocket electrical apparatus in No. 125 of your valuable Magazine), or any other of your Correspondents, will give the receipt of varnishing a ribbon for the purpose of using with the pocket electrical phial, it will much oblige. Galvanus describes the power of his eight-ounce phial as exploding gunpowder and setting fire to spirits of wine. I have made a Leyden phial of eight-ounce size, as an electrical jar, and, although it acts very powerfully, I cannot by any means cause it to produce the powerful effect Galvanus states,

It fires the detonating silver powder; and a three-ounce phial I have had some years does equally well.

I am, Sir,
Your obedient servant,
G. M. H—N.

INQUIRY.

NO. 182.

MACHINE FOR PULVERISING BONES.

SIR,—I am a farmer, and also a constant reader of your valuable work. I am anxious to apply mechanical power, whenever proved to be economical, to the various necessary operations in farming; and as I now wish to try the effect of bones as a common manure, I shall feel much obliged to any of your readers who will kindly inform me of the cheapest and most effectual mode of pulverising the bones, as also the quantity that may be used, with good effect, per acre?

I am, Sir,
Your obedient servant,
J. W. A.

Ireland, February 8th, 1826.

ANSWER TO INQUIRY.

NO. .—RAISING WATER.

SIR,—If I understand "A Distant Inquirer" rightly, he does not wish to know the best method of applying his power for the purpose of raising water, but the quantity he may expect either of his engines to deliver into a certain receptacle by means of a pump 16 inches diameter, which receptacle may be 96, 156, or 176 feet above the water in his well.

I will not give a direct answer to your Correspondent, because I do not know the construction of his machine, and "circumstances seemingly very trifling may produce great effects in the performance of a pump."

But supposing, after his machinery is driven, he has a disposable power equal to ten pounds per square inch on his engine piston (which he may safely calculate upon, unless his machinery is either very complicated or massive, or his engine out of order), it might be made to deliver the following quantities per hour:—

Receptacle 96 feet high	30-inch cylinder,	44100 Imperial gallons,
	33	51720
156	30	31980
	33	38040
176	30	28920
	33	34440

But, in the manner these machines are commonly put together, he may be well satisfied with four-fifths of the above quantities.

It is obvious the pump-piston must move at a different rate per minute for each receptacle.

The above calculations are for 12-inch pipes; larger ones would be preferable if all the circumstances of the construction corresponded.

He may expect the smaller engine to require, for merely raising the water without driving his machinery, from 32 to 36, and the larger from 36 to 39 bushels of coal for twelve hours, depending on their quality and the state of his engine.

Wishing him every possible success in his undertaking,

I remain, Sir,
Yours respectfully,
S— Y—,
A Young Engineer.

NEW PATENTS.

James Fraser, Houndsditch, London, engineer; for an improved method of constructing capstans and windlasses. Dated February 25, 1826.—Two months to enrol specification.

Benjamin Newmarch, Cheltenham, Gentleman; for certain inventions to preserve vessels and other bodies from the dangerous effects of external or internal violence on land or water, and other improvements connected with the same. Dated February 25, 1826.—Six months.

The same, for a preparation to be used either in solution or otherwise, for preventing decay in timber or other substances, arising from dry rot or other causes. Dated February 25, 1826.—Six months.

James Fraser, Houndsditch, London; for a new and improved method of distilling and rectifying spirits and strong waters. Dated March 4, 1826.—Two months.

Robert Midgley, Horsforth, near Leeds, Gent.; for a method, machinery, or apparatus, for conveying persons and goods over or across rivers or other waters, and over valleys or other places. Dated March 4, 1826.—Six months.

George Anderton, Chickheaton, Yorkshire, worsted-spinner; for improvements in the combing or dressing of wool and waste silk. Dated March 4, 1826.—Two months.

James Neville, of New-walk, Shad Thames, engineer; for a new and improved boiler or apparatus for generating steam with less expenditure of fuel. Dated March 14, 1826.—Six months.

Nicholas Hogesippe Manicler, of Great Guildford-street, Southwark, chemist; for a new preparation of fatty substances, and the application thereof to the purposes of affording light. Dated March 20, 1826.—Six months.

NOTICES TO CORRESPONDENTS.

The account of Mr. Brunel's New Gas Engine, which we intended to give in our present Number, is postponed for want of room till our next, when we shall also give a second communication from Mr. Cheverton in further explanation of his invention.

H. P.'s plan is by no means new; it was acted upon about fifty years ago, and proved abortive.

"Clavis" will find a letter for him at the Post-Office, Scarborough.

The "Young Dominie's" letter is clever, but not adapted to our pages.

The conclusion of the article on the Principles of Chronometers will appear in our next.

Communications have been received from R. M. J.—Telos—F. R.—S. P.—A Traveller—Uncle Ben—John Price—Dr. Rutledge—Hammer—A Joiner—A. B.—An Old Subscriber — Norfolkiensis — D. B.—Querist.

*** *Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills, Jowett* and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

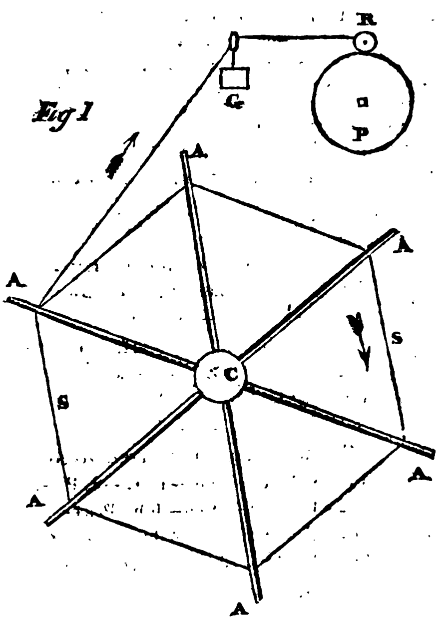
Mechanics' Magazine,

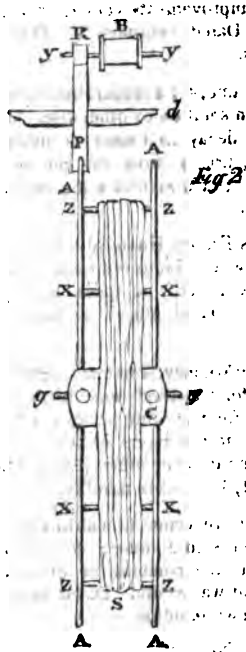
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

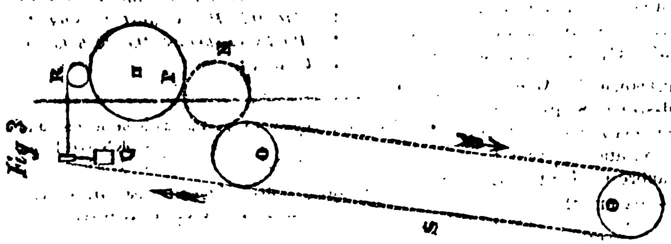
No. 138.] SATURDAY, APRIL 15, 1826. [Price 3d.

SILK-WINDING MACHINES.

MR. BADNALL'S PATENT.







SILK-WINDING MACHINES—MR. BADNALL'S PATENT.

SIR,—I was a good deal surprised at seeing, in page 339 of your valuable Magazine, an answer from Mr. G. Scott, to my letter inserted at page 279. He refers me to the *Stockport Advertiser*, but not being in the habit of reading country papers, I of course was not aware that the subject had been canvassed there; every one must see, however, from the way Mr. Scott has handled the subject, that "there is something in it more than meets the eye." The account I have heard of the invention is briefly this:—A man in the employ of Messrs. Pontifex, the coppersmiths, was sent down to Leek, to set up some coppers they had made, and which were necessary in the tanning process invented by Mr. Spilsbury (in the patent for which Mr. Badnall is a partner). In going through the factory, when they were winding by the common process, the thought struck this man, of relieving the stress on the thread by giving motion to the swift, instead of drawing it forward by the thread. This idea was communicated to Mr. Badnall, who put up a small machine on that principle, and finding it answer, he took out a patent for the invention. The coppersmith alluded to, I concluded, was Mr. Scott, for he called on a friend of mine, a machine-maker, in Spitalfields, to inquire what he would get a very considerable quantity of the patent winding-machines up for, as he expected very large orders; and, in the course of the conversation, Mr. Scott informed my friend that he (Scott) was the inventor. You therefore see, Sir, Mr. Scott has only himself to blame for having the invention charged on him. Nothing is more probable than that such an original thought, as this was, should come from a man totally unacquainted with the manufacture; practical men make improvements, but original thoughts come, nine times out of ten, from the uninitiated. I beg to assure Mr. Scott, that I had not the most remote idea of "troubling" him, nor will I; it must be a volunteer, if any thing, such as I suppose his communication of the 1st of March to be. However, I cannot help remarking, that it is "passing strange" that Mr. Scott should have replied to my letter in answer to Mr. Abbott, and yet say he has no knowledge of "what Mr. Abbott has stated respecting the inventor, or the invention of the machine."

I must now beg leave to introduce a few lines about the machine itself (which I do without meaning the least offence to either Mr. Scott or Mr. Badnall), the fame of which (*before it was tried*) was rung on every change throughout the silk trade. The present mode of winding raw silk is very old, and notwithstanding the fault which has been found (and in many cases very justly) with the defective machinery employed by silk-manufacturers, is the parent of the cotton-winding machine, and of the soft silk machinery now in use, which, I think, I can show by the following descriptions of their different parts. The same letters apply to the same part in all the drawings.

Description.

Fig. 1 is a side view, and fig. 2 a front view, of the raw silk-winding machine. AA is the swift, which is composed of twelve smooth rods let into a wooden axis, C, in the centre of which is a hole; through this hole a wire, *gg*, is put, on which the swift revolves; the diameter of the swift is about 2 feet 6 inches. You will perceive that the sticks are placed, six on each side, in two rows, which rows are about three inches apart. The rods opposite to each other are tied together with string at ZZ, for the purpose of supporting the silk, SS, and moveable pieces of wood, XX, are placed across, to keep the strings tight. P is a pulley, about six inches over, with small flutes in it, and is fixed on a shaft, *dd*, moved by a wheel at the end of the machine. R is a small roller, about one inch over, with similar flutes; this roller is fixed on a short spindle, *yy*, on which is put the bobbin, B, to receive the silk; the thread passing from the

swift through the crooked wire in the guider-rod, G, is shown by a dotted line; the guider-rod, G, moves backwards and forwards, and distributes the thread regularly upon the bobbin. I have omitted the guider-rod, fig. 2, to enable me to show the shaft, *d*, more distinctly. You will perceive, then, when motion is given to the shaft, *d*, the pulley, P, will cause the roller, R, with which the bobbin is connected, to revolve and pull forward the silk into the bobbin, and causes the swift, A, to be put in motion, and to give out the thread in the direction shown by the arrows. I need hardly say, that there is a frame to support the peg, *g*, of the swift, the ends of the spindle, *y*, and the guider-rod, G.

By this very simple machine, hundreds of which are connected together in one room (the front space required for each being only six inches), the raw silk is wound. The alteration made for winding cotton and dyed silk is this:—Little wheels, called runners, *oo*, in fig. 3, are substituted for the swift, and the roller, R, and pulley, P, are not fluted, which latter has been partially introduced into the raw silk trade, and is, I think, a great improvement, particularly in fine silk, as the roller, R, acting by its own weight only, stops directly it meets with any unusual resistance. In Badnall's patent, the exact plan described in fig. 3 is adopted, except that a roller is introduced between the pulley, P, and the top runner, *o*, as shown by a dotted wheel, N, and which causes the runner to revolve, and takes the pull off the thread. To prevent the bobbin winding the thread faster than the runners give it out, the thread passes over a wire placed near the guider-rod, and which acts as a lever, the other end of it being connected with the spindle, *y*; so that, in case the thread becomes too tight, it bears hard on the lever, which it presses down, and raises up the other end, together with the bobbin, and stops it. Directly the thread gets slack, and ceases to act on the lever, the bobbin descends by its own weight, and begins to revolve.

This plan appeared a very good one at first sight, and raised very high expectations in the trade; but, like many other supposed improvements, it looked very well in theory, but failed in practice. The very machine alluded to in page 112, as having been put up by Mr. Scott, and the first order he had executed, has not succeeded. Mr. Pattison has laid it aside, or sent it back as useless; and, I understand, Mr. Pattison says it is no improvement, and he will back his old machinery against it for any thing, which is the strongest condemnation it can possibly have, as Mr. P. is the first throwster in the trade, and one on whose judgment the trade can rely. By the old mode of winding, the swift does not go round more than eight times a minute; taking a skein of silk at 24 inches over, and the bobbin at two inches, it will give near 100 turns per minute for the bobbin, which is near three times as fast as they wind at the best mills in Italy. Now, Mr. Badnall says, in his answer to "A Weaver, page 267, vol. IV., that his winding bobbins revolve above 500 times a minute, which is more than five times as fast as the English, and 15 times the Italian. But this rapidity gains nothing, the same number of hands being required to wind a pound, whether the machine goes fast or slow, as has been proved by experiment; and the work, when performed, not being so good when hurried, the manufacturer only gains a loss by adopting the new plan. The principal reason it has failed, I take it, is, that in a skein of silk there are a great number of places which are very fine, and consequently nothing but waste, as it cannot be worked, being too slight to bear the spin, or even to support its own weight in coming off the bobbin. Now, by the patent plan, all this waste is wound on to the bobbin; and as the silk on the bobbin cannot be got off again, the whole becomes useless. By the old plan, the degree of tension required to pull round the swift causes it to break at the weak places, and is made into waste by the winder, which is considered by the trade preferable to the plan of winding it up, even if not saddled with the danger of losing the whole. There does not seem any probable

means of remedying this defect, which is a radical one, and the natural consequence attendant on propelling the swift.

I know that several of your readers are in the silk trade, and are much more competent to handle this subject than I am. I wish they would take it up, as it is really of great importance, in the present state of the trade, that the merits of every plan should be laid fairly before the public, that every thing should be done to bring forward real improvements, and that they should be properly encouraged. My advice to the trade is, that they shall throw aside all their old wooden machinery and bungling spindles, and imitate the Manchester people, in employing nothing but the first rate mechanics to make their machines—they would soon find their account in it; the difference of price between the good and bad would be more than made up by the superior produce.

I am, Sir,

Your very humble servant,

H. Jones.

NECESSITY OF AN IMPROVED MODE OF WARMING HOUSES—WRETCHED CONDITION OF CHIMNEY-SWEEPS.

(To the Editor of the Mechanics' Magazine.)

Sir,—Allow me to ask, through the medium of your excellent Magazine, whether the adoption of gas-stoves or fires, in dwelling-houses, would be at all practicable? The principal points which present themselves for consideration are, first, the relative degrees of heat which might be expected from the combustion of certain quantities of gas; and, secondly, the relative price between the last-mentioned substance and coal. The latter part of the question is, however, but of secondary consequence, as the manufacture would, in my opinion, soon accommodate itself to any increased demand.

If the result of these inquiries should render the plan at all feasible, I have no doubt that its *introduction* into dwelling-houses would be very easy; in fact, I would pledge myself to show how a convenient and elegant stove might be constructed for the purpose.

My attention was more immediately called to the subject by the letter of your Correspondent (T. J. M.) in the 128th Number of your Magazine, and indeed I consider this subject one of the highest importance, and am rather surprised at the apathy which mankind in general manifest towards it.

The common method of warming our houses now, is really the same, at least in principle, as that employed by the savage in his hut, and which the ancient Britons themselves must have used a thousand years ago; for, it is nothing more than the combustion of raw materials in a room which has an aperture for the emission of smoke. Some improvement has indeed taken place in the mechanical and decorative parts, adapted to the interior, such as uniting the smoke of different fires in one chimney, continuing the chimneys through a series of rooms or floors, and building them with more regularity; the fires have also been much improved by elevating them from the hearth, and the stoves have been ornamented with various devices.

But whilst these measures have been carrying forward in behalf of the middling and upper classes of society, as well as a great majority of the lower, there is yet another portion of our fellow-creatures (the poor chimney-sweepers), who, by these very means, particularly by the flues being lengthened, and contracted in their other dimensions, are not only debased below the rest of their species, but actually subjected to a more degrading occupation than any which the brute creation has to perform.

It may be said that there are other instances in which human nature is obliged to submit to equally humiliating trades; this is admitted, but one is surely enough to "tackle" at a time.

The object of your Correspondent, T. J. M., seems to be the improvement of stoves and chimneys in general, chiefly, however, with regard to the convenience of the owner. I perfectly agree with T. J. M. in thinking that some change is very desirable on our own account, if indeed it be not essentially necessary; but would further put it to him, as a question, whether he thinks it worth while to propose any extensive alteration in the present odious system, without taking the claims of humanity largely into account?

As to the injury which this system does to the community at large, let us only look at the estimate made by Mr. Brande, that one hundred thousand chaldrons of coals are annually wasted (that is, unconsumed, because allowed to fly off in a state of smoke) in London alone, and that the major part of this vast quantity of heterogeneous matter goes at the same time to contaminate the atmosphere. This statement alone will, I hope, awaken the curiosity of your many ingenious and scientific readers, and create in their minds a desire to abate such an intolerable nuisance.

We may learn from the good effect produced by restraining the salt water floods in the marshes of Italy, by means of flood-gates at the rivers' mouths, how important it is to preserve a pure atmosphere, and at the same time how greatly it is within the power of man to do this by mechanical means. And though the case is different in England, inasmuch as the air is here deteriorated throughout the year by man himself, yet this the rather more urgently demands some remedial measures from his hands, than if it were caused by the natural state of things.

The atmosphere, which, it has been well surmised, once existed in a much purer state, but which is now loaded with such vast quantities of heterogeneous matter as scarcely to subserve the purposes of life for the short period of a century, is, by this vile chimney apparatus, still further burdened with clouds of filthy smoke, which, whether approached externally or inhaled, alike absorb the liquids of the body, and thus gradually prey upon the vitals of the human system.

It is customary to talk about the great impurity of our English atmosphere, as giving colds, catarrhs, and the like disorders; but considering the very highly cultivated state of our country in general, and the consequent improved condition of the air, is it not probable that more detrimental qualities have been attributed to the natural element than really belong to it? On the other hand, is there not every reason to believe that the numerous consumptions and chronic diseases in our island, are particularly liable to be induced by the penetration of dry and parching materials, like soot (or smoke) into the animal economy? And when we consider the amazing quantity of this stuff which is vomited forth by our large cities and manufacturing towns throughout the kingdom, it is surely not any exaggeration to say that, at least, one-tenth of the mischief resulting from atmospherical impurities is owing to this sooty, smokey system of ours, the principal features of which appear to be extravagance, cruelty, and inconvenience.

All I have been saying is, no doubt, in opposition to strong prejudices, rooted in the long-continued habits of our country for many generations; but, with all submission to superior judgment, this appears to me an additional reason why the subject should be now investigated, and the inhuman system, if possible, demolished. It is certainly natural, indeed it is right, that mankind should prefer any plan of which they are practically reaping the advantages, to one which seems excellent only in theory. And though I have here taken the liberty to speak prospectively, and with some confidence, of the improvements which I think may be fairly anticipated in this department of domestic economy, I cannot avoid at the same time comparing them with many instances already afforded in the scientific world, of grand designs which have been retarded in

execution by the comparatively barbarous customs, and rendered nearly abortive by the obstinate prejudices, of the ages in which they were attempted.

Did I affect to consider this proposition original, or in any way my own, I should be far from calling it a grand design; but this is not the case, and none, I think, will charge me with it: all I wish to suggest is, that the plan of meliorating the condition of those poor creatures who are employed in chimney sweeping, of improving the fire-places and chimneys of our houses, and of rendering the last-named more easy to be built, is one which has a direct tendency to promote the welfare of society; that it will meet with the strong opposition which such beneficial measures ever have experienced, and that therefore it must of necessity be urged and prosecuted in spite of prejudice.

In concluding, Sir, allow me to express a hope, or rather the strong conviction which I feel, that, amongst your numerous and intelligent Correspondents there are many who will honour this subject with their serious consideration, without regarding the sneers of the trifling or the hard-hearted.

I remain, Sir,

Your obedient servant,

A FRIEND TO HUMANITY AND REFINEMENT.

Terra Incognita.

PRINCIPLES OF CHRONOMETERS.

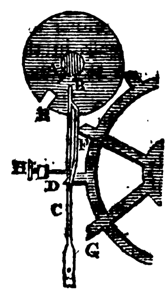
From Dr. Gregory's excellent System of "Mathematics for Practical Men."

(*Concluded from No.* 133, *page* 324.)

37. In the escapement of the cylinder or dead-beat, an increase of the maintaining power renders the vibrations larger, and at the same time slower.

Because the greater pressure of the tooth on the edge of the cylinder throws it round through a greater arch; and its increased pressure on both surfaces of the cylinder retards its motion.

The upper part of the above diagram exhibits the anchor recoil; the lower, Graham's dead-beat escapement.



The second diagram represents Mr. Arnold's watch escapement. The pin, A, projecting from the verge or axis of the balance, moving towards B, carries before it the spring, B, and with it the stiffer spring, C, so as to set at liberty the tooth, D, which rests on a pallet projecting from the spring. The angle, E, of the principal pallet has then just passed the tooth, F, and is impelled by it until the tooth, G, arrives at the detent. In the return of the balance, the pin, A, passes easily by the detent, by forcing back the spring, B. The screw, H, serves

to adjust the position of the detent, which presses against it.

38. The escapement can render those vibrations only isochronal, whose inequality proceeds from the maintaining power, and not such as are produced by external agitations.

39. The effect of external agitations on the balance may be counteracted by the double escapement.

In this escapement, two equal balances are so connected, that they vibrate through equal angles, but in contrary directions; by which means the one must always be accelerated as much as the other is retarded by any external agitation. But, as Mr. Cummins observes, when balances are connected by means of teeth, there arises a resistance which, however small, when applied in this most delicate part, will tend to diminish the momentum of the balances.

40. That escapement is best in which the duration of the action of the balance-wheel on the pallets is least with respect to the time of vibration.

Hence the detacl l escapement is the best, which appears to have been the invention of the ingenious artist, Mr. Thomas Mudge, who made a watch on this construction for the late King of Spain, Ferdinand VI., in the year 1755.

41. The time of the vibration of the balance is increased by heat, and diminished by cold.

First, because the length of the spiral spring is increased by heat, and therefore its force diminished, and the contrary by cold. 2dly, The diameter of the balance is increased by heat, and therefore also the time of vibration; and the contrary by cold.

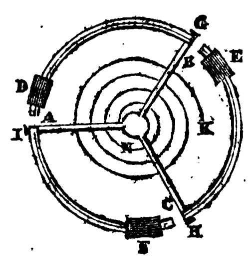
42. That balance is the most perfect which, without the compensation of a thermometer, is most subject to the influence of heat and cold.

Because the obstructions from oil and friction act as a compensation to the expansion or contraction of the spring and balance; therefore that balance which is most affected, is freest from the influence of oil and friction.

43. The errors in the going of a watch, arising from the change of temperature, may be corrected by varying the length of the balance spring.

Nevertheless, as it is extremely difficult to form an an isochronal spiral, any variation in its length is dangerous, because we shall thus probably lose that point which determines its isochronism.

44. The errors in the going of a watch, occasioned by the variation of temperature, may be corrected by varying the diameter of the balance.



This may be effected by dividing the rim of the balance into two or more separate parts, GD, IF, HE, each of which is composed of two plates of metal of different expansibility, rivetted together, the least expansible being nearest the centre, N, and carrying at one end, D, F, E, a weight, whilst the other is connected either with the rim of the balance, or one of its radii. Now, if the temperature increase, the exterior plate expanding more than the interior, the compound will become more concave towards the centre, and consequently the end which carries the weight will approach the centre of the balance, and on that account the vibrations will be rendered quicker. At the root of each thermometer there is a screw, G, I, H, by which the diameter of the balance may be increased or diminished, so as to alter the time kept by the chronometer, without interfering with the adjustment for heat

and cold; and if the magnitude and position of the weights be properly regulated, they will correct the error arising from the variation of the diameter of the balance caused by the variation of temperature.

M. Young's Analysis.

The reader who wishes to acquire *practical* knowledge on this subject, may advantageously consult *Hatton's Introduction to the Mechanical part of Clock and Watch Work.*

MAGNITUDE OF THE SUN.

SIR,—Your Correspondent, Mr. Hall, in page 338, expresses a wish to know the method used by me of determining the diameter of the circular space which could be occupied by globes of equal size to that of our earth, and constituting together a bulk equal to that of the Sun.

I beg to observe, that the main object I had in view was to impress upon your readers an idea of the *immense magnitude of the Sun*, when compared to that of our earth, rather than the geometrical method of solving the problem, although, as a mathematical question, it may be interesting to some of your readers.

The principle upon which my result was obtained was simply as follows:—

Let the reader draw three equal circles in mutual contact, by lines drawn from the centres of these circles, and form an equilateral triangle.

Now, it is well known that there will be 60° out of 360° in the triangle taken out of each circle, or 180° in the three circles, equal to a semicircle, when the radius is 1, the area of the semicircle $=\frac{3.14159}{2}=1.57079$; and the area of the triangle will be equal to $\sqrt{3} = 1.73205$: deducting, therefore, the area of the semicircle, 1.57079, we obtain the unoccupied space, ·16126, or something more than 1-10th of the space occupied by the sectors of the circles; if we, therefore, add 1-10th of the area of all the circles to itself, the sum will be the area of the whole space occupied by the globes, the diameter of which will be found nearly as stated in my answer. If Mr. Hall had adopted the numbers in my solution for the diameter of the sun and earth, a similar result would have been obtained. I am not disposed to find fault with the algebraical mode of investigating the question adopted by Mr. H, but preferred that which did not require the solution of a quadratic equation, and which, by the general reader, might be more readily comprehended.

As an approximating rule for practical purposes, we may consider that the sum of the areas of any number of equal circles, when placed in contact, will be the whole space occupied as 10 to 11 nearly, or as 39 to 43 more nearly.

I am, Sir,

Your obedient servant,

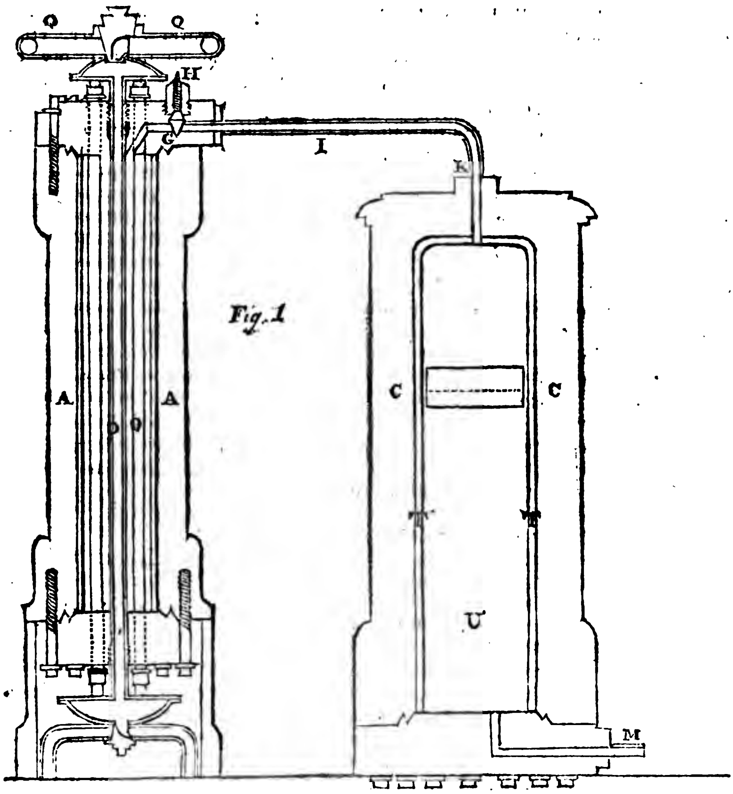
B. BEVAN.

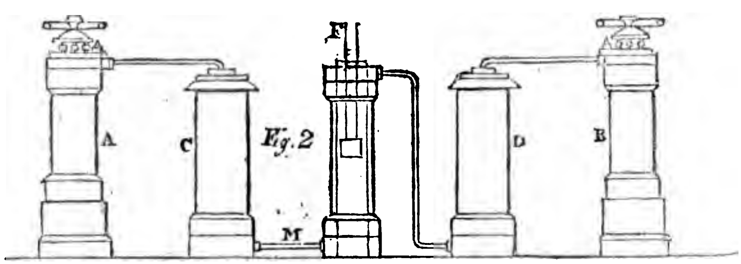
PRIZE CHRONOMETERS.

It appears by the Report of the 10th month (for February), that Cotterell, No. 674, was stated to be withdrawn in January, by mistake; and also that M'Cabe, No. 167, was withdrawn in February. The remaining twelve we give in the order they stood at the end of last month.

	No.	"
French	20/3912	2,64
French	975	2,51
Molyneux	862	4,77
Harris	678	5,75
Desgrange	35	6,46
Cotterell	647	8,03
Cathro	1703	8,54
M'Cabe	168	9,06
Cathro	1685	9,10
Ellicott	947	9,61
Jackson	512	9,68
Webster	638	10,49

DESCRIPTION OF MR. BRUNEL'S CARBONIC ACID GAS ENGINE.





The apparatus, as shown at fig. 2, consists of five distinct cylindrical vessels; the two exterior vessels, *a* and *b*, contain the carbonic acid reduced to the liquid form, and are called the *receivers;* from these it passes into the two adjoining vessels, *c* and *d*, termed *expansion vessels;* these last, having tubes of communication with the working cylinder, *e*, the piston therein (shown by dots) is operated upon by the alternate ex-

pansion and condensation of the gas, giving motion to the rod, *f*, and consequently to whatever machinery may be attached thereto.

As the working cylinder, *e*, is of the usual construction, no further description of that part of the apparatus is necessary; and as the two vessels on one side of the cylinder are precisely similar to those on the other, a description of the receiver, *a*, and the expansion vessel, *c*, will apply to their counterparts, *b* and *d*; the two former (*a* and *c*) are therefore given in a separate fig. (1) on a larger scale, in section, that their construction may be seen, and their operation better understood. The same letters of reference designate the like parts in both figures.

The communication of the condensing pump (before-mentioned) with the receiver, *a*, is through the orifice, *g*, which can be stopped at pleasure by the plug or stop-cock, *h*. When the receiver has been charged with the liquid and closed, a pipe, *i*, is applied to and connected to the expansion vessel, *c*, at *k*. *ll* is a lining of wood (mahogany), or other non-conductor of heat, to prevent the absorption which would otherwise be occasioned, by the thick substance of the metal. The expansion vessel is connected through a pipe, *m*, to the working cylinder, *e*; these vessels contain oil, or any other suitable fluid, shown at *n*, as a medium between the gas and the piston.

The receiver is a strong gun-metal vessel, of considerable thickness, in the interior of which are placed several thin copper tubes, as represented at *ooo*; the joints of these tubes through the top and bottom of the receiver are made perfectly tight by packing. The use of these tubes is to apply alternately heat and cold to the liquid contained in the receiver, without altering very sensibly the temperature of the cylinder. The operation of heating and cooling through the thin tubes, *ooo*, may be effected with warm water, steam, or any other heating medium; and cold water, or any other cooling medium. For this purpose the tubes, *ooo*, are united by a chamber and cock, *pp*, by the opening of which, with the pipes *oo*, hot and cold water may be alternately let in and forced through, by means of pumps, the cocks being worked in a similar manner to those in steam-engines.

Now if hot water, say at 120°, is let in through the tubes of the receiver, *a*, and cold water at the same time through the receiver, *b*, the liquid in the first receiver will operate with a force of about 90 atmospheres, while the liquid in the receiver, *b*, will only exert a force of 40 or 50 atmospheres. The difference between these two pressures will therefore be the acting power, which, through the medium of the oil, will operate upon the piston in the working cylinder. It is easy to comprehend that, by letting hot water through the receiver, *b*, and cold water through the opposite one, *a*, a re-action will take place, which will produce in the working cylinder, *e*, an alternate movement of the piston, applicable by the rod, *f*, to various mechanical purposes as may be required.

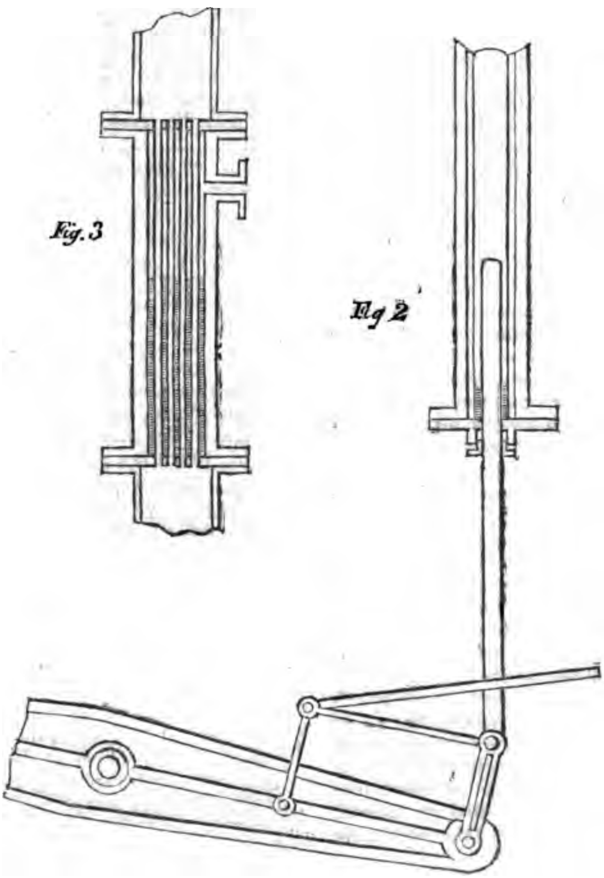
It is to be observed, that the use of the gasometer and of the forcing-pumps is simply for obtaining the gas, and for charging the receivers with the liquid. When the receiver is once charged, and has been closed with the stop-cock, *h*, the gasometer and forcing-pumps are to be disconnected from the receiver by unscrewing the pipe, *i*, at the joint. The same pipe may, however, be used as the means of connecting the receiver with the expansion vessel; the adoption of two distinct pipes for these purposes is intentionally avoided, as it would become necessary in consequence to have two orifices, as well as two stop-cocks. It is obvious that no difficulty exists in connecting the forcing pump with both receivers, as the small pipes used for that purpose may be made to reach either.

The most essential parts of this interesting invention are—the internal application of the tubes for conveying the heating and cooling medium; the cylindrical form, and the manner they are applied, rendering them capable of resisting the intense external pressure of the liquid, yet

admitting of their being made so thin as to allow of the rapid and complete transmission of heat and cold through them; and the arrangements by which the receivers acting in opposition to each other produce, without any aid of intermediate valves, an alternating action, attended with scarcely any perceptible diminution of power from friction, the force being so great, that it may almost be deemed irresistible.

MR. CHEVERTON'S NEW GAS POWER-ENGINE.

(*Continued from our last, page* 389.)



Miscellaneous Remarks.

The oil being subject to so great a pressure, it is probable that some of it may pass at the piston joint, but as the like quantity would repass at the succeeding stroke, there will be no gradual accumulation in either

of the gasometers; and in case of a considerable quantity passing at a time, which will be known by observations made through the glass tubes, the piston must be fresh packed. As the engine would, notwithstanding, continue to work, and it may be inconvenient to have it stopped, a latitude should be allowed in the gasometers for accidental elevations and depressions of the oil. In repacking the piston, the escape of the gas may be prevented, by making the floating-boards act as valves, with the oil somewhat above the joint, which would exclude its admission into the cylinder. It has been with me a question of doubtful solution, whether these boards, if freely floating on the oil, would sink or swim after being a little time under the circumstances in which they would be placed. If, as I am inclined to think, the former should happen to be the case, it would not be difficult to apply a remedy.

If by any accident the plungers should be prevented from descending, the flow of cold water through pipe N, would quickly bear up the oil beyond the generator; or, at least, so high, as to remove all danger of overstraining the vessels.

In practice, the hot oils should be contained in a *double* vessel, in order that, being heated together, they may have the same temperature. The different sides of the piston will be impressed with different forces, in consequence of the rod occupying part of its area. If not corrected, a serious inequality of power would, in this engine, be the result. Compensation should not be made by difference of temperature, as that would be always liable to irregularities and accidents; but by adjusting, at first, the relative heights to which the plungers are permitted to ascend, under the influence of the regulating agent.

There is no concussion or sudden impulse in this engine, by the instantaneous action of the power in its full force, as is the case with steam, especially of high pressure. However rapid the strokes, the development of available power is relatively gradual.

The cylinder is represented as being horizontal, but it may, of course, be placed in the usual position; and the rest of the apparatus may be so disposed around it, as to allow the whole being enclosed within a safety cylinder. Without anticipating a future inquiry, I would here just remark, that this safety cylinder is not suggested under the idea of a pressing necessity for its adoption, but with a view to allay the apprehensions of the timid by an appeal to their eyes, rather than to their reason; for I have no hesitation in saying, that I think the apparatus may be made incomparably less liable to explosion than the common low pressure steam-engine. It may be thought that the horizontal cylinder is needless—that the gasometers may be used as cylinders, having pistons working in them with a downward stroke, with a certain depth of oil on their surface, and connected by parallel motions to the opposite ends of the beam. There are practical objections to this plan. In that which has been offered, there is only one joint against the atmosphere to keep oil-tight, which is a piston *rod* joint. In the proposed alteration there would be two, and these *piston* joints. If, to obviate the last objection, piston rods only (or plungers) are employed, with a little oil at the bottom of the gasometer (see fig. 2), the power of the engine would be limited by the area of their transverse sections; which, though very considerable, would not in some cases be sufficient, unless the pressure was most enormous. For ordinary powers this plan may be adopted, but the arrangement is not a good one.

There would be no insuperable difficulties in altering the new agent to a single force engine, and a plan upon this idea, and well adapted for purposes, where only a small power is required, will be given in another communication. Indeed, the forms may be varied without end. I have several plans, in which compactness has been particularly studied, and

should be happy to communicate one or two, were it not for occupying too much of your valuable miscellany with this subject. There is one in which the whole of the operations are comprised in one vessel, except that of heating the oil. But difficulty of construction, and other considerations, induce me to give the preference to an engine more in parts.

In concluding these unconnected remarks, I beg to observe, that however diversified the apparatus, the two leading principles on which I have proceeded must, in my opinion, be adopted in every scheme which pretends to a practical character. They are these :—

1. To use identically the same substance in the gaseous or fluid forms, for every accession or remission of force. Hence there are neither valves nor pumps.

2. To impart external motion either through, or through the intervention of, some liquid body; that is, to have an hydraulic, and not a packing air-tight joint. The first is new, the second is as old as Papin and Newcomen.

Practicability.

They only who have had some experience in converting speculations into realities, can have a proper conception of the difficulties which unexpectedly arise, in attempting to carry into execution the most matured projects, however feasible they may appear, or however correct, indeed, the principles on which they may be founded. Not that theory is a fallacious guide, or is at variance with practice, but that in all cases comprising any thing absolutely new, it is necessarily incomplete; because all knowledge is founded on experience. It may be correct so far as it goes, but something unknown may nullify the whole. In all cases affording novelty only of combination, the probability of the success of a first essay will be in proportion, not only to the care which has been bestowed on the theoretical view, making it to comprehend and provide for every particular, but to the simplicity of the scheme as a whole; because intricacy of arrangements, and multiplicity of modifying influences, render it difficult, and very often impossible, to assign *à priori* the ultimate result; that is, to make the theory perfect.

In reference to the first particular, or the necessary data which are yet wanting, only one or two things require to be determined (I take it for granted they are unknown)—Will the new liquids have a chemical action on the metals? This confessedly lies at the foundation of the project to employ them universally as mechanical agents. I say universally, because though it should be found that *all* of them have an active deteriorating effect on *all* metals, yet I should not despair of means being found, by which they may be made available in most cases where steam is at present employed. This untoward result is not, however, probable, though I confess I am suspicious of some of the acids. Should it be found that only the costly metals can resist corrosion, the expense would not preclude their employment, for only the tubes of the generator need be made of them; it being the liquid, and not its gas, which would injure the vessels—at any rate, they would require only to be lined. Will the new liquids, or their gases, have a chemical action on all the oils? If this should happen to an injurious degree, compounds, or other unctuous substances, on which they would have little or no effect, may be substituted. The probability is, that the oil being dosed with a certain quantity, no further diminution of the liquid in the generator would take place. Mr. Faraday makes mention of the nitrous oxide floating on water, the latter having a small portion of it in solution. The alternate mechanical absorption and evolution of gas, by difference of pressure, has already been mentioned and provided for. Will the gas, by suspension or solution, carry over particles of the oil at the time of condensation into the generator, to the ultimate exclusion of the liquid? There

is the same probability that it will carry them back again, and faster than they came. All other necessary preliminary experiments have been made by Sir H. Davy and Mr. Faraday. As to details of construction, the improvers of steam-engines have furnished abundant data. They have sufficiently determined what is within practical limits, and have established, by numberless experiments, the best methods of operating.

It only remains, then, to inquire, under the second particular, whether there is any thing in the combination of means and agencies offered in the present project, that can render success doubtful, though characterized, as it indisputably is, by simplicity. Some of the difficulties which have been foreseen, have already been adverted to in the preceding miscellaneous remarks. The most important point, that of safety, is reserved for a separate head of inquiry. Previous to an investigation of other particulars, it is proper to observe, that our present notions of practicability, or at least of what is *practical*, must be modified in some degree. Hitherto, economy of power and means have been the considerations of first importance, and to which even that of safety has been made subordinate. To a proposal for a steam-engine, however safe, portable, and desirable, in other respects, but in which there would be great friction, direct loss of power, and a waste of fuel, we should immediately say, that it was not adapted for practice. Now, it is the striking peculiarity of the present case, that so immense is the power at command, and so little its cost, that convenience, safety, and compactness, are first entitled to attention; and those objectionable points, though not entirely to be overlooked, become only of secondary importance.

It is material to know, whether the alterations of the temperature of the liquid will be sufficiently rapid to admit of a simultaneous movement of the crank and fly wheel with the evolution of the gas. Short and quick strokes are not admissible, because of the waste of caloric, and the little force elicited. Besides, a certain time *must* be allowed for the heating and cooling of the tubes of the generator. It should be observed, that the liquid employed being so volatile and so small in quantity, its temperature can never be perceptibly different from that of the tubes. It is only to the time occupied in varying *their* temperatures that we need attend. Here one of the advantages of having capillary tubes is apparent, for this form admitting the least thickness of metal consistent with strength, it can be heated and cooled with greater rapidity. Another form may be given to the generator, in which much thinner tubes, but of the same strength, may be employed. It consists of a cylindrical vessel, with open tubes passing through it longitudinally, up and down which the cooling and heating mediums flow. (See fig. 3.) Here the pressure, with regard to the tubes, is external. They are also easily cleaned; but there are disadvantages which are perhaps more than a counterbalance.

It is due to Mr. Cheverton to state, that we received his first communication *prior* to the account which appeared in a contemporary journal, of the 11th of March, of Mr. Brunel's Engine, and which, we believe, was the first published. Mr. C., in a letter to us, of the 5th of April, says—"It was not till the present hour that I saw any description of Mr. Brunel's Engine, except the few notices contained in your Magazine, No. 131, from which I think it impossible for any one to form an idea of its construction." Mr. C. adds, "I observe with satisfaction (of one sort), that the principles which so able an engineer has adopted, are the same on which I have proceeded, though our plans are different; and here I flatter myself I have an advantage, because I have made so ample provision for the regulation of the power, and the bringing it forth to time, which I conceive are the greatest difficulties to be overcome. The former should not be

liable to such fluctuation as will be unavoidable by making it dependent on the temperature of the heating medium. Trifling variations therein must produce great irregularities."

(*To be concluded in our next.*)

QUESTIONS AS TO WHEEL-CARRIAGES.

D. L. E. K. G. would feel obliged to any of the numerous Correspondents of the Mechanics' Magazine, who would inform him what is the moving force required for a Carriage, and what its running weight. For example, if a carriage weigh 5 cwt., what is the force required to set it in motion? and what is the force required to keep it in motion? It is evident that the former must be greater than the latter, because there is the inertia of the body to overcome.

D. L. E. K. G. would wish to know, secondly, how the running weight of a carriage is affected by the size of the wheels, by the height of the carriage, or by any other incidental circumstances? and whether the running weight can be expressed in terms of any of them? The easiest line of draught has already been the subject of much discussion in the Magazine.

D. L. E. K. G. would wish to know, thirdly, why the wheels of wagons are not of the same diameter throughout their whole thickness?—Is it that the load may not act perpendicularly upon them? And, if so, is not the effect counterbalanced by the very much increased wear and friction of the wheel?

MOVING THE GLOBE.

SIR,—In answer to your Correspondent, T. M. B. (page 371, No. 136), as to how long it would have taken Archimedes to move the globe one inch, provided he could have found a fulcrum for his lever? I beg to submit the following calculation :—

The first thing requisite to be obtained is the computed gravity of the earth; therefore, considering its diameter to be 8000 miles, its cubical contents, in feet, will be 1,189,478,400,000,000; to reduce which to weight, I take 25 feet to be equal to a ton (which, on an average, I conceive would be about correct, as the earth contains matter much more dense than that of which, at its surface, we consider 27 cubic feet equal to a ton), according to which ratio the weight to be raised would be 47,579,136,000,000 tons!

A man's power, applied at the end of a lever, must not be considered at more than a hundred weight, as whatever it may exceed that would only be sufficient to give that end preponderance enough to put it in motion: as the weight, therefore, to be raised is 951,582,720,000,000 times as heavy as the power (which will be found by reducing the above tons into cwts.), the lever must also, according to the principle of mechanics, be so many times as long from the fulcrum to the power as from the fulcrum to the weight to be raised; and, as the time lost is always equal to the power gained, it follows that, to produce a motion of an inch in the one end of the lever, the other must pass through 951,582,720,000,000 inches, or 180,224,000,000 miles. Therefore, supposing the strength of Archimedes, above the one hundred weight allowed (which would produce a balance only), sufficient to have propelled the lever through the air at the rate of 12 feet per minute, it would have taken him (provided he had lived so long) no less a time than 151,184,062 years to move the globe through the space of one inch only.

I am, Sir, your constant reader,

Y. Z.

PREPARATION OF COFFEE AT ROSETTA.

One of the most curious sights in Rosetta, so famous for the finest Mocha coffee, is the preparation of that article for use. After roasting the coffee, it is pounded in immense mortars; three Arabs working at a time with enormous pestles, each as large as a man can raise. The capacity of the bottom of the mortar being only equal to the reception of one of these at a time, the pestles are raised according to the measure of an air sung by an attendant Arab, who sits near the mortar. The main purport of this curious accompaniment is, to prevent the hand and arm of a boy, kneeling near the mortar, from being crushed to atoms. The boy's arm is always within the mortar, which allows room for each pestle to pass in turn without bruising him, if he places it in time against the side of the vessel; but, as after every stroke he must stir up the powder at the bottom of the vessel with his fingers, if the precise period of each blow were not marked by the measure of the song, his arm would be struck off. A sight of this process is sufficient to explain the cause of the very impalpable nature of the coffee-powder used in Turkey, where the infusion more resembles the appearance of chocolate than of coffee, as we prepare them for beverage here.

STUPENDOUS REMAINS.

Mr. Wilson, in his interesting Travels through Turkey, Greece, &c., gives the following account of some stupendous Remains of Masonry, which he saw at Balbeck:—

"Supposing that three of these stones are placed end to end, they will be found to extend 190 feet. Two of them are upwards of 60 feet in length, and the others exceed these about three feet more; and, what is more extraordinary, they are raised from 20 to 30 feet above the foundation. We are lost in conjecture, as much as in viewing the Pyramids of Egypt, with regard to the plan adopted to raise and fit these enormous stones into their proper places, at the construction of this building, and as to the nature of the scaffolding employed, and also the machinery to bring them to the spot.

"I proceeded to a rock, about half a mile from the place, where these must have been supplied. I remarked here one huge stone, which had for ages been cut and prepared to be removed; which, on measuring, I found to 20 feet in length, 17 in breadth, and 14 in thickness; and it appeared as new and fresh as if the operation had only taken place the preceding day."

A long description of Balbeck and its ruins finishes with the following observation:—

"I am therefore prompted to invite the artist, and man of taste, to direct his views to this most interesting spot, where he will find not only the highest antiquities, but subjects for the chisel and pencil, and also for serious contemplation."

THE STARS.

A very important astronomical fact has been discovered by Messrs. Herschel and South. The late Sir Wm. Herschel directed the attention of astronomers to the importance of determining the distances and positions of double and triple stars; or stars which appear single to the eye, or when seen through an inferior telescope, but when viewed with one of higher magnifying powers, are found to consist of two or more distinct stars: Sir W. H. published descriptions and names of 702 such double and triple stars. The above Gentlemen instituted a series of observations to determine the existence and amount of annual parallax of these stars; but this object was soon lost sight of amid the more extensive views of the construction of the universe, which gradually unfolded themselves. They have clearly established the existence of binary systems, in which two stars perform to each other the offices of sun and planet. They have ascertained, with considerable exactness, the periods of rotation of more than one such pair. They have observed the immersions and emersions of stars behind each other, and have detected among them real motions sufficiently rapid to become measurable quantities in very short intervals of time.

NOTICES TO CORRESPONDENTS.

R. N. is mistaken: the promise he refers to applied to another Correspondent.

Felix may have hit, as he imagines, on a very *happy* idea, but he has not succeeded in making it intelligible. If he will favour us with a more specific description, and a correcter drawing of fig. 3, his communication shall have a place.

Dr. Burney's Meteorological Report will appear in our next.

Communications have been received from A Son of Vulcan—S. M. R.—An Old Correspondent—A Chip—A Constant Reader—S. W. W.—H. B.—F. N.—T. B.—Tyro—A. W.—Smith Smithson—Ursa Major—N. N.—S. M. I. R.—Orion—James Simpson.

*** *Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills*, *Jowett*, and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

Mechanics' Magazine,

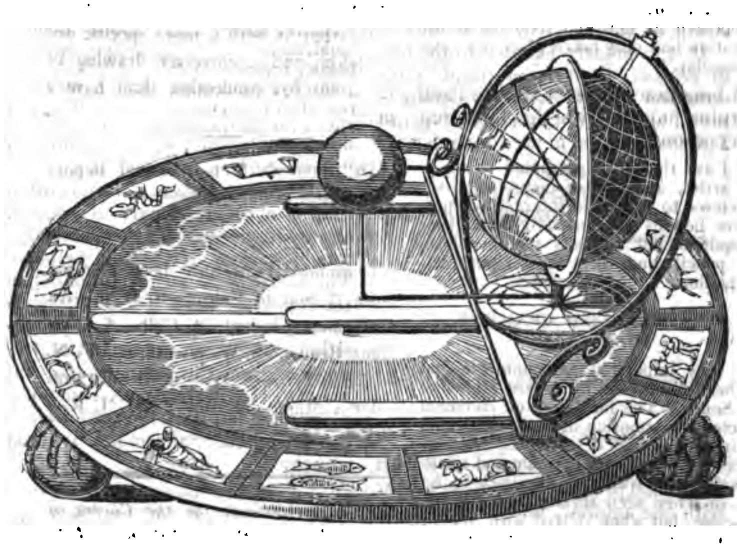
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 139.] SATURDAY, APRIL 22, 1826. [Price 3*d*.

"True industry does not consist in executing by known and given means; the proof of art and genius is to accomplish an object in spite of difficulties, and find little or no *impossibility*."

Emperor Napoleon..Las Cases' Journal.

NOCTIDIAL GLOBE.



SIR,—The following is a description of the Noctidial Globe, of which I send you a drawing.

A terrestrial globe is suspended from an elliptical frame, inclined 23½ degrees, making an angle with the tablet, which is parallel with the earth's orbit, of 66½ degrees. By a curious combination of levers, a double motion is produced, one describing the parallel motion of the earth in its orbit, and the other, by means of a terminator or brass circle, to define the illumined from the dark side of the earth, dividing the globe into day and night, as the earth would be divided on any day indicated on the dial beneath the globe.

The ball in the centre of the orbit, representing the sun, has a pointer, as a central ray, proceeding from it, to show the sun's place in the ecliptic, and for solving various other problems. Round the tablet are the signs of the Zodiac.

I can, from actual experience, affirm that a single lesson with this machine is amply sufficient to explain to a person not at all acquainted with astronomy, the annual and diurnal motions of the earth, the cause of the changes in the seasons, and of the different lengths of days and nights, as well as other matter connected with the doctrine of the spheres.

A globe, mounted in this way, is applicable to the solving of all the problems usually performed on a terrestrial globe of the present construction; while the absurdities, so perplexing to beginners, in which many of the problems on that instrument are involved, are avoided.

It is peculiarly adapted to the use of schools, as it is of simple construction and not liable to derangement, and will not exceed in expense a globe mounted in the common way.

I am, Sir,
Yours respectfully,
ROBINSON CRUSOE.
Portsmouth.

ENGLISH GRAMMAR.

(*Continued from page* 382, *No.* 136.)

Of the Preposition.

A Preposition is a word used with nouns and pronouns, to connect them with one another, and to show how they belong or relate to each other; as, "Hercules," said she, "I offer MYSELF *to* YOU, because I know YOU are descended *from* the GODS, and give PROOFS *of* that DESCENT *by* your LOVE *to* VIRTUE, and APPLICATION *to* the STUDIES proper *for* your AGE."

The words printed in small capitals, in the above sentence, are the nouns and pronouns connected by the prepositions.

One great use of prepositions in English, is to express those relations, which in some languages are chiefly marked by what are called cases, or the different endings of the noun.

Example.

LATIN.	ENGLISH.
Caput,	the head
Cap*itis*,	*of* the head
Cap*iti*,	*to* the head
Cap*ite*,	*with* or *from* the head.

In the Latin language we change the ending of the noun: in the English we cannot do this; and therefore we use the prepositions, *of, to, with,* &c. instead.

The preposition takes its name from *præ*, before, and *pono*, to place; and it bears this appellation because it is *placed before* nouns and pronouns. We have about 69 prepositions, of which the following are the principal:—

Above, about, after, against, along, amid, among, around, at, before, behind, below, beneath, besides, between, beyond, by, concerning, during, ere, except, for, from, into, in, of, off, on, over, since, through, throughout, till, to, toward, under, unto, upon, up, within, without, with.

Remember, the same word is often used as a different part of speech, and by its use we are to determine to which class of these it belongs. The word *above* stands foremost in the foregoing list: if I say, "He is *above* a mean action," it is a preposition, because it connects the pronoun *he*, and the noun *action*; but if I say, He dwells *above*, it denotes place, and describes the verb dwells: in this sentence, therefore, it is an adverb.

Of the Conjunction.

The Conjunction is a part of speech that is chiefly used to connect sentences, so as out of two or more sentences to make but one; as, "Virtue leads to honour, *and* ensures happiness; *but* vice degrades the understanding, *and* is succeeded by infamy." Sometimes, however, it is used to connect only words; as, "Love *and* a cough cannot be hid." Conjunction takes its name from

con, with, and *jungo*, to join. I do not know their exact number: the Rev. David Blair, in a note at the bottom of the 11th page of his Grammar, says there are about 19, and afterwards furnishes us with a list containing 27, which, he says, are the principal ones. Here followeth David's list:—

And, as, because, both, but, consequently, either, for, forasmuch, if, inasmuch, lest, neither, notwithstanding, nor, or since, that, than, then, though, till, therefore, unless, until, wherefore, yet.

Example.

(*Introducing the Prepos. and Conjunc.*)

N. B. The prepositions are printed in Italics, the conjunctions in small capitals.

"O my country! land *of* my birth, my love, AND my pride; land *of* freedom AND of glory; land *of* bards AND heroes, *of* statesmen, philosophers, AND patriots; land *of* Alfred AND *of* Sidney, *of* Hampden AND *of* Russell, *of* Newton, Locke, AND Milton; may thy security, liberty, generosity, peace, AND preeminence, be eternal!"

Of the Interjection.

Some grammarians have thought, that the Interjection has no more claim to be reckoned as a part of speech than the neighing of a horse, or the lowing of a cow: this was the opinion of the late Mr. Lindley Murray; and yet we are told by him, that "words are articulate sounds, used by common consent, as signs of our ideas." And are not the exclamations, *Ah! alas! hark! hush! adieu!* words used by common consent? If so, they must be parts of speech, and are as much entitled to be treated as such, as any other sounds which we employ. But to our definition. An interjection is that part of speech which denotes any sudden affection or emotion of the mind. We have about 68 of these, of which the following are some of the principal:—

Hey! ah! alas! ha! hark! pshaw! hist! hum! huzza! hip! ho! halloo! soho! oh! adieu! farewell!

In my next communication I shall sum up what I have attempted to explain, and introduce an exemplification of every part of speech, with which I shall conclude my introductory observations.

I am, Sir,
Your very obedient servant,
W. SMITH.

Castle-House Academy,
April, 1826.

PRIZE CHRONOMETERS.

The following is the list of the Chronometers in the order in which they stood for the prizes at the end of the 11th month (March); and, as the trial must end the last day of this month (April), we shall take the earliest opportunity of laying the result before our readers.

	No.	"
French	20/3912	2,65
French	975	3,50
Molyneux	862	5,19
Harris	678	6,51
Desgrange	35	6,54
Cotterell	647	8,15
Cathro	1703	8,60
M'Cabe	168	9,05
Cathro	1685	9,35
Ellicott	947	9,56
Jackson	512	9,74
Webster	638	10,42

ECCENTRIC TURNING.

SIR,—I desire to be informed by any of the readers of the Mechanics' Magazine, if they are aware of any other method of performing Eccentric, and Eccentric Oval Turning,* without the aid of the usual chucks: as I am aware of a different principle (simple in its construction), by which the same operations are performed, and in much greater variety.

I am, Sir,
Your most obedient servant,
JOHN SIMPKIN.

Rillington, near Malton.

* I believe cycloids may be done by the same method.

SOLDIERS' KNAPSACKS.

SIR—I should be glad if you would call the attention of some of your ingenious Correspondents to the present mode of carrying Soldiers' Knapsacks, which, on a long march, both gall and weary them. It has occurred to me, that a steel carriage, of the substance of ladies' stay busks, might be made with a hook to go over the shoulder, instead of the strap which goes round the arm, and cuts so much under it.

I am, Sir,
Your constant reader,
AN OLD SOLDIER.

MR. CHEVERTON'S NEW GAS POWER-ENGINE.

(*Continued from our last, page* 415.)

The continuity of the medium is interrupted, and consequently the difference of temperature is quickly diminished, whereas it should be kept as nearly the same as possible, in order to produce rapidity of effect. This objection may be partly obviated, in reference to the cooling process, by making the space above the generator so considerable as to allow a current of water to be continually ascending during the whole of the time. This method is applicable to, and should indeed be employed with, the form first suggested. But it cannot be adopted in reference to the heating process, without foregoing the advantage of regulating the power in the manner before described; and surely such an essential point, in a case where the difference of a few degrees will create a difference of pressure equal to as many atmospheres, should not be wholly intrusted to an adjustment of temperature. If the tubes are thinner (which is the only advantage) the bore will be very small, consequently the water will have a very sluggish motion, and much diminish the beneficial effects of the current. Then there is the mass of metal (requisite for strength) that forms the case of the generator, which will constantly tend to neutralize both the heating and cooling processes, if kept at the temperature of the atmosphere; and if retained at that of the water, it will oppose an obstacle to the increase of the elastic force, which the oil, confined as it is in capillary tubes, will not rapidly overcome. On the whole, therefore, this form of the generator, apparently so advantageous, will not, I think, be found to answer in practice, so well as the first. I may add, that a contrivance is very easily devised for clearing the tubes of the latter of external incrustations, supposing that the changes of temperature do not prevent deposits.

The next particular to which attention should be directed, in order to expedite the heating and cooling processes, is the temperature of the mediums. The more the *difference* is increased between the *highest* temperature of the generator and that of the heating medium, and between its *lowest* temperature and that of the cooling medium, the quicker will the change be effected. But the latter difference cannot be made considerable without prodigiously increasing the minimum elastic force of the gas, or resorting to artificial means for lowering the temperature of the water. The first measure will in some degree defeat itself, for thicker tubes will be required; besides, there are many obvious reasons why the lower temperature of the generator should be kept as low as possible. The second is open to many practical objections. It is much easier to furnish heat than cold, and far more easy to regulate it. I am therefore of opinion, that a liquid whose gas has a less elastic force at the mean temperature of spring water than the carbonic acid or the nitrous oxide, will be found to answer best in practice; for economy of heat, as before remarked, is but a secondary object. The greater range of temperature which it would take, in order to produce the same difference of the contrasted elastic forces, would

be rather an advantage than otherwise, for, requiring less precision of regulation, it would be more suitable for practical operations. By making the variations of temperature at a higher part of the scale, the same power would be obtained, though at the expense of a little more caloric; the minimum elastic force being much less, the tubes of the generator would be made thinner; and the difference between their temperature and that of the water being also considerably augmented, they would cool with greater rapidity. The impropriety before adverted to will now be seen, of raising the gasometer to a higher temperature than is just sufficient to prevent an accumulation of liquid in it; since the principal difficulty being to cool with sufficient rapidity, and to such a degree, as to produce a proper velocity of condensation, every thing which can retard it by the radiation and the regression of heat, is to be carefully avoided. On the return of the gas, a little waste by condensation can be spared. To check it, the gasometer is lined with wood, and it acts beneficially in another way, by resisting more than metal the subsequent communication to the gas, of the little superior heat it is allowed to retain.

But to return. As, therefore, it is highly objectionable with respect to some of the liquids, to hasten the cooling process, by making a considerable difference between the lowest temperature of the generator and that of the water; and as in all cases it must be desirable to make the former as low as possible, it will be proper so to regulate the motion of the plungers, that, of the time occupied by an entire revolution of the crank, the cooling medium may continue by far the greater proportion of it in contact with the generator, and the heating medium the remainder.—Things being equal, the mean temperature of the generator would coincide with the mean of the two mediums; but this difference of time, together with the greater capacity of water for caloric than that of oil, and its greater conducting power, will bring it considerably nearer to the temperature of the cooling medium; or, being given, the alternations *cateris paribus* will proceed with greater rapidity. As compensation for the cooling difference being less than the heating difference, is principally made in the circumstance of time, it follows that the calorific influence of the generator will not be diminished, in duration, exactly in proportion with the period of its being heated. In consequence of the slower cooling than heating of the tubes, there is a momentum of caloric, if I may so express myself, which will extend the time and degree of its being in excess. The resulting force will be more slowly retarded than it was accelerated. Now, the energy of the engine may be confined to the fourth part of the revolution of the crank; consequently, if the temperature of the oil were proportionably raised, its application may be but momentary, and yet produce sufficient effect, both in degree and duration. The cooling process thus occupying almost the whole period of rotation, there would be a greater number in a given time.

The preceding is confessedly the most obscure part of the subject, and has occasioned some prolixity. From experience only can be ascertained the minutiæ concerning it, which, though not affecting the general views here taken, will yet require considerable attention, in order to determine the niceties of procedure which will be most successful in practice. The same may be said of the proper *timing* of the changes of temperature, so as to produce the most equable motion, especially as it will in some degree depend on the thickness of the tubes.

Add to the above observations, that the temperature of the generator would not be required to oscillate more than 30 or 40 degrees, to produce an immense difference of pressure—that the thickness of its tubes may not be more than from the sixteenth to the eighth of an inch; and little doubt can remain, that the strokes of the piston may be effected with sufficient rapidity, to

admit of an immediate connection with the motion of the fly-wheel. If, however, this result cannot be obtained without too great a nicety for practice, it must be placed on another axis than that of the crank,* or the sun and planet motion must be introduced. It may be asked, why not adopt this plan at once? There is one case, and that of vast importance—I mean navigation—where the introduction of cog-wheels into the prime movements should be studiously avoided. Here, also, short and rapid strokes are desirable. The hope of surmounting these difficulties has led me into the preceding exposition. It is true, that the cylinder may be placed horizontally, or nearly so, and thus long strokes be effected; but a quick succession is the desideratum, in order that the necessary velocity may be given to the paddles, without increasing the diameter of the wheel. In all other cases, the usual mechanical means can be resorted to for obtaining velocity from a slow first mover.

There is, however, another mode of proceeding—to adopt the idea of the old steam-engine-makers, before they had brought their power under proper command for mechanical purposes. This is, to render the prime movement, and the subordinate one, which gives motion to machinery, quite independent of each other in respect to velocity, by cutting off all direct connection, and making the communication through the medium of water, elevated to a reservoir, and acting by its gravity on a wheel, it produces a fine equable motion, and perfectly under command—a method which has continued in use even to the present day. In another communication will be presented a plan for its application to the gas engine, and suitable for a small power.

This form of using the power, it is plain, is not sufficiently compact for the propelling of carriages or vessels, though the principle of *applying it indirectly* may be found practicable in these cases. A plan has been devised—indeed, many may be suggested—by which it is thought this may be accomplished, without any considerable addition of appendages, or departure from compactness. It may, indeed, be preferred in all cases; for though, by acting on the principle just mentioned, a greater loss of power would be experienced, the following advantages would result:—

The temperature of the heating medium, which should then be water, need never much exceed that of the generator, for it may take its time both in heating and cooling; it may, therefore, be lowered down to nearly the temperature of the cold water. Less strength of tubes and vessels, for the same power, will be required. The great nicety with regard to the prime mover, of regulating the power to the load; and the greater nicety peculiar to the case, of regulating its development to time, are difficulties altogether avoided. Regulation in the usual manner, will be applied to the subordinate mover, when it will admit of greater precision by a procedure less refined. The power will be suited to the occasion, by an augmentation or diminution of the temperature of the water, the maximum force being at the boiling point. Or the water may be kept constantly boiling (a small fire may then be used), and the power be adjusted by the plungers, either in the manner proposed for its direct regulation, or by varying the quickness of the strokes. This remote regulation is discretional, and if made self-acting also, which would be proper in some cases, will require no sort of nicety, and may operate in a very general way. If the vessels, or rather the safety contrivances, are made at first to withstand the pressure produced

* As in Dr. Cartwright's engine, who contemplated, probably, that by his mode of condensation, the strokes would not, or rather should not, be allowed to proceed with the same velocity as when the injection plan is adopted. I cannot but take occasion here to remark, that notwithstanding the Doctor's engine has been neglected chiefly because of his condenser, it is not less efficient on that account, the precaution just mentioned being observed.

at 212 degrees, by no possible accident, temerity, or negligence, could they ever be overstrained. If great power is not required, only one generator, one alternating apparatus, and one gasometer, will be necessary. The liquids which have high elastic forces at low temperatures, may with more propriety be employed. The tubes of the generator may be made abundantly strong, for it will not be particularly desirable to have them of the least thickness consistent with strength. They may even be made of lead, if that should be found among the cheap metals, to resist most effectually the action of the liquid.

I am, Sir,

Your obedient servant,

BENJ. CHEVERTON.

Kingsdown, Bristol.

(*To be continued.*)

SQUARING NUMBERS.

SIR,—It has been long known that the product of the sum and difference of two numbers is equal to the difference of their squares, and hence, when a square is required to contain an area which is expressed by a number not a square, we can obtain two squares, whose difference shall equal the required area; viz. find any two factors which shall give the area as a product, and they shall possess the following property, viz. the greater shall be the sum, and the lesser the difference, of two numbers, which shall be the roots of squares, the difference between which squares shall be equal to the required area. $204 \times 154 = 31416$; and, as they are the sum and difference of two numbers, we obtain those numbers as follows:—

Sum	204	204
Difference ...	154	154
	2)358	2)50
	179	25

Let us now square these two quantities, viz. .... $179^2 = 32041$
$25^2 = 625$

Difference of the two squares .. 31416, and equal to the approximating area of a circle, the diameter of which is 200.

It is almost needless to observe that residual squares can be obtained by Euc. 47.1; for if a right-angled triangle be formed, and the hypothenuse made equal to 179, the base equal to 25, the square on the perpendicular will equal the difference.

We may now observe the two factors, 204 and 154, and we shall find that the greater exceeds the lesser by 50, and that quantity is one-fourth of the diameter of the corresponding circle, from which we derive this corollary:—there is, in every circle, a portion of its diameter equal to $\frac{154}{200}$, which if made the side of a square, and that side be produced until the production equal the one-fourth of the diameter, there must be formed a parallelogram, which shall equal the circle, for its area must be $154^2 = 23716$
and the rectangle 154×50 7700

31416

as before.

Now this may all be resolved into an algebraic equation, from which we derive a general formula. The above would be expressed as follows: $x^2 + 50\,x = 31416$; and if it be required to find the squares whose difference shall equal a circle four times greater than 31416, we proceed as follows: — When we double the diameter of a circle, we quadruple its area; but when we double the diameter, we double its fourth part, so that our equation shall be $x^2 + 100\,x = 125664$; and in the solution of it we proceed thus:—We add to each side the square of half the coefficient of x, viz. $x^2 + 100\,x + 2500 = 125664 + 2500$: each side is now a perfect square, and extracting the root of the right-hand side, viz.—

$125664 + 2500 = 128164$ (358
9
65)381
325
708)5664
5664

we obtain the root of the greater square, and half the coefficient of x is the root of the lesser, viz.

$358^2 = 128164$
$50^2 = 2500$

125664

But, on reference to our former square roots, we find our new ones are only

their duples, from which we derive this corollary:—whatever may be the difference between two squares, if you double their roots, the new square shall have a difference quadruple that of the old.

I remain, Sir,

Your most obedient servant,

Cork. RICHARD DOWDEN.

CUBIC EQUATIONS.

(*Continued from page 375, No. 136.*)

SIR,—Before proceeding with the remainder of this subject, I must first notice some errors in my last communication.

1st. For $\frac{8}{n^2}y$, read $\frac{q}{n^2}y$.

2nd. For $a^{\frac{1}{2}}\,3\,a^{\frac{1}{2}}\,z^2$, &c. read $a^{\frac{1}{2}}$, $3\,a^{\frac{1}{2}}\,z^2$, &c.

3rd. For $y^3 - \frac{q^3}{r^2} = \frac{q^3}{r^2}$, read $y^3 - \frac{q^3}{r^2}y = \frac{q^3}{r^2}$.

Having found that the positive value of y, in the equation $y^3 - ay = a$, is between the limits $a^{\frac{1}{2}}$ and $a^{\frac{1}{2}} + \frac{1}{2}$, to whatever class the equation belongs; we shall now inquire what the precise limits are when the equation falls under the irreducible case. When this takes place, it is well known that $\frac{a^3}{27}$ is greater than $\frac{a^2}{4}$ or $a \urcorner \frac{27}{4}$, that is, $a \urcorner 6.75$; hence $y^3 - 6.75\,y = 6.75$ is the equation that limits the reducible from the irreducible case. In this equation, the positive value of y is 3 exactly; also, since $y^3 = ay + a$, it is apparent that a and y must increase or diminish together $\therefore$ as a cannot be less than 6.75, it follows that y cannot be less than 3.

Now, when $y = a^{\frac{1}{2}} + z$, we found that $2\,a\,z + 3\,a^{\frac{1}{2}}\,z^2 + z^3 = a$; and in this equation it is obvious that, as a increases, the positive value of z will also increase. Therefore, substituting the minimum value of a, we have $z^3 + 3\,\sqrt{6.75}\,.\,z^2 + 13.5\,z = 6.75$, from which z is found to be $= .4019238 +$ $\therefore$ when the equation $y^3 - a\,y = a$ falls under the irreducible case, the positive value of y is between the limits $a^{\frac{1}{2}} + .4019238 +$ and $a^{\frac{1}{2}} + \frac{1}{2}$.

2ndly. When the equation $y^3 - a\,y = -a$ falls under the irreducible case, it might be shown nearly in the same way that $a \urcorner 6.75$, and that the least value of $y = 1\frac{1}{2}$, also $y \urcorner a^{\frac{1}{2}} - 1\frac{1}{10}$ but $\angle\, a^{\frac{1}{2}}$.

Having now ascertained the limits of the dependent equations $y^3 - a\,y = a$, and $y^3 - a\,y = -a$, when both fall under the irreducible case, we shall now proceed to explain the construction and application of the two following Tables, from which a near numerical approximation to the three roots of any cubic equation that falls under the irreducible case may be easily obtained.

Suppose the value of y, in the equation $y^3 - a\,y = a$, is 3, then $3^3 - 3\,a = a$ $\therefore 4\,a = 27$, or $a = \frac{27}{4}$ $\therefore a^{\frac{1}{2}} = \left(\frac{27}{4}\right)^{\frac{1}{2}}$ $= 2.59808$; hence $3 - 2.59808 = .40192$ is the correction to be added to the square root of a to give y. In the same way, if $y = 3.1$, then $a = \left(\frac{3.1^3}{4.1}\right)^{\frac{1}{2}}$ $= 2.69557$, and $3.1 - 2.69557 = .40443$ is the correction to be added to the square root of a to give y. In this way the following Table was calculated.

TABLE I.

For finding a near value of the positive root of the equation $y^3 - ay = a$, or the negative root of the equation $y^3 - ay = -a$, when both equations belong to the irreducible case of Cardan's rule.

y	Square Root of a	Correction.
3.0	2.59808	.40192
3.1	2.69557	.40443
3.2	2.79319	.40681
3.3	2.89092	.40908
3.4	2.98877	.41123
3.5	3.08671	.41329
3.6	3.18475	.41525
3.7	3.28287	.41713
3.8	3.38108	.41892
3.9	3.47936	.42064
4.0	3.57771	.42229
4.1	3.67613	.42387
4.2	3.77461	.42533
4.3	3.87315	.42685
4.4	3.97175	.42825
4.5	4.07040	.42960
4.6	4.16910	.43090
4.7	4.26784	.43216
4.8	4.36664	.43336
4.9	4.46548	.43452
5.0	4.56435	.43565
5.1	4.66327	.43673
5.2	4.76222	.43778
5.3	4.86120	.43880
5.4	4.96022	.43978
5.5	5.05926	.44074
5.6	5.15834	.44166
5.7	5.25745	.44255
5.8	5.35657	.44343
5.9	5.45573	.44427
6.0	5.55492	.44508
6.1	5.65413	.44587
6.2	5.75336	.44664
6.3	5.85261	.44739
6.4	5.95188	.44812
6.5	6.05117	.44883
6.6	6.15048	.44952
6.7	6.24981	.45019
6.8	6.34915	.45085
6.9	6.44852	.45148
7.0	6.54790	.45210
7.1	6.64729	.45271

y	Square Root of a	Correction.
7.2	6.74761	.45329
7.3	6.84613	.45387
7.4	6.94556	.45444
7.5	7.04502	.45498
7.6	7.14449	.45551
7.7	7.24397	.45603
7.8	7.34345	.45655
7.9	7.44296	.45704
8.0	7.54247	.45753
8.1	7.64200	.45800
8.2	7.74152	.45847
8.3	7.84108	.45892
8.4	7.94063	.45937
8.5	8.04020	.45980
8.6	8.13977	.46023
8.7	8.23935	.46065
8.8	8.33894	.46106
8.9	8.43854	.46146
9.0	8.53815	.46185
9.1	8.63777	.46223
9.2	8.73739	.46261
9.3	8.83702	.46298
9.4	8.93666	.46334
9.5	9.03630	.46370
9.6	9.13695	.46405
9.7	9.23561	.46439
9.8	9.33528	.46472
9.9	9.43495	.46505
10.0	9.53462	.46538
11	10.53169	.46831
12	11.52992	.47078
13	12.52711	.47289
14	13.52528	.47472
15	14.52369	.47631
16	15.52228	.47772
17	16.52103	.47897
18	17.51996	.48004
19	18.51891	.48109
20	19.51800	.48200
25	24.51451	.48549
30	29.51217	.48783

y	Square Root of a	Correction.
35	34.51045	.48955
40	39.50918	.49082
45	44.50818	.49182
50	49.50738	.49262
60	59.50617	.49383
70	69.50529	.49471
80	79.50464	.49536
90	89.50410	.49590
100	99.50370	.49630
200	199.50186	.49814
300	299.50124	.49876
400	399.50093	.49907
500	499.50075	.49925
600	599.50062	.49938
700	699.50054	.49946
800	799.50046	.49954
900	899.50042	.49958
1000	999.50038	.49962
2000	1999.50018	.49982
3000	2999.50012	.49988
4000	3999.50009	.49991
5000	4999.50007	.49993
6000	5999.50006	.49994
7000	6999.50005	.49995
8000	7999.50004	.49996
9000	8999.50003	.49997
10000	9999.50003	.49997

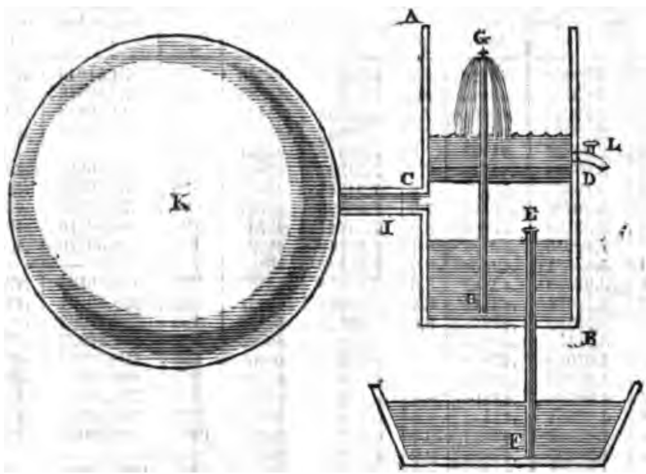
And when the square root of a is greater than 10000, the correction may be taken $= .5$.

The remainder of this subject, Mr. Editor, I must still postpone to some future period; and I remain, Sir, your most obedient servant,

April 11th, 1826. G—— S——.

RAISING WATER BY THE HEAT OF THE SUN.

[To the Editor of the Mechanics' Magazine.]



SIR,—Your obliging insertion of my former communications has induced me to send you the plan of a little invention of mine, for Raising Water by means of the Heat of the Sun.

Description.

Let AB represent a cylindrical vessel made of metal, open at the top, but closed at the bottom.

CD, an air-tight division in it, made of wood, as being the worst conductor of heat.

EF, a pipe with a valve at the top of it. This pipe is fixed, in an air-tight manner, into the bottom of the cylinder, and the lower part of it is immersed in water.

GH is a pipe, with a valve at the top of it, fixed in an air-tight manner into the division in the cylinder.

I is a pipe, which makes a communication between the upper part of the lower division of the cylinder, and the globular vessel, K.

Now, supposing the lower part of the cylinder to be nearly full of water, it will be seen, that when the sun shines upon the globular vessel, K, it will, by heating it, cause the enclosed air to expand, and thereby force the water into the upper division, through the pipe GH. When the sun sets, or is obscured by clouds for any length of time, the vessel, K, will cool, and the air within contracting, it will draw the water up through the pipe EF, and fill the lower half of the cylinder. This water will, upon the sun's shining again on K, be forced into the upper division, and thus water will be raised in small quantities.

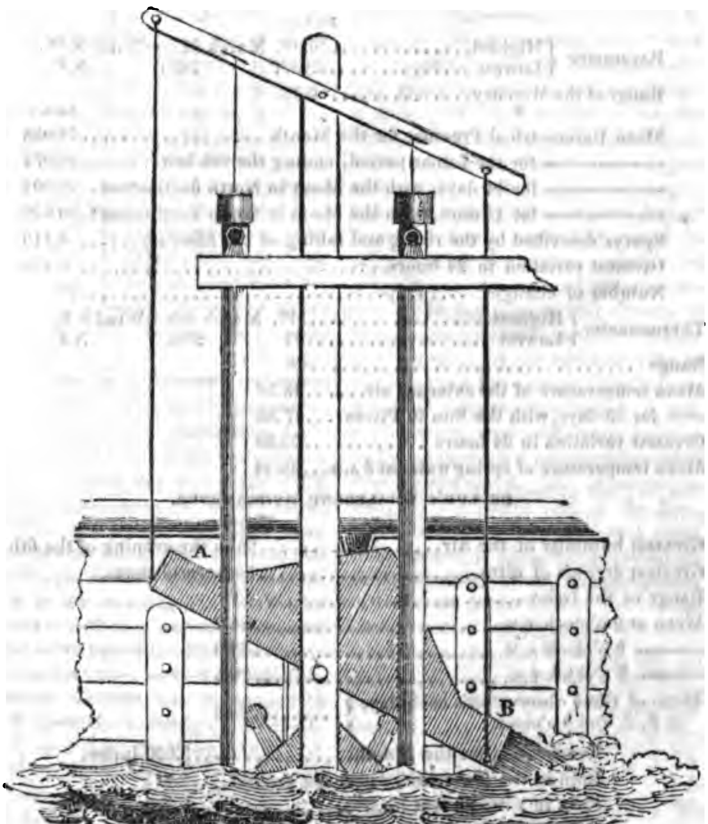
L is a cock for drawing off the water as it is raised.

I know not whether the idea is original or not; if not, I hope I may be excused for thus troubling you, as I never saw or heard of any thing of the kind before.

I am, Sir,
Your most obedient servant,
H. C——LL.

IDEA OF A SELF-ACTING PUMP.

[To the Editor of the Mechanics' Magazine.]



SIR,—I think the prefixed drawing is too simple to require any detailed explanation, except as to the action of the vessel, A, B, for which I must refer your readers to my former communication on this subject, in No. 100, page 254, of your excellent work. In the above drawing, the side B is represented as discharging the water which produced the motion, while the side A is filling to perform the same operation in its turn.

I am, Sir,

Yours respectfully,

ROBINSON CRUSOE.

Portsmouth.

RESULTS OF A METEOROLOGICAL JOURNAL, FOR MARCH, 1826.

Kept at the Observatory of the Royal Academy, Gosport, Hants,

BY DR. BURNEY.

		Inches.		
Barometer	Highest	30.36,	March 31st—Wind	N.W.
	Lowest	29.37,	24th	N.E.

Range of the Mercury.............. 0.99.

	Inches.
Mean Barometrical Pressure for the Month	29.958
—— for the Lunar period, ending the 8th inst	29.971
—— for 14 days, with the Moon in North declination	29.902
—— for 15 days, with the Moon in South declination	30.040
Spaces described by the rising and falling of the Mercury	6.110
Greatest variation in 24 hours	0.470
Number of changes	23

Thermometer	Highest	59°,	March 9th—Wind	S.E.
	Lowest	31	26th	N.E.

Range 28

Mean temperature of the external air......45.56

—— for 30 days, with the Sun in Pisces....47.38

Greatest variation in 24 hours 21.00

Mean temperature of spring water at 8 A.M...49.44

DE LUC'S WHALEBONE HYGROMETER.

	Degrees.
Greatest humidity of the Air	95 in the evening of the 6th.
Greatest dryness of ditto	50 several times.
Range of the Index	45
Mean at 2 o'clock P.M.	64.2
—— 8 o'clock A.M.	72.3
—— 8 o'clock P.M.	71.6
Mean of three observations each day, at 8, 2, and 8 o'clock	69.4

Evaporation for the Month...............3.520 inches

Rain in the Pluviameter near the ground....2.615

Rain in ditto 23 feet high 3.370

Prevailing Wind, N.E.

A SUMMARY OF THE WEATHER.

A clear sky, 5; fine, with various modifications of clouds, 13; an overcast sky, without rain, 9; rain, 4.—Total, 31 days.

CLOUDS.

Cirrus,	Cirrocumulus,	Cirrostratus,	Stratus,	Cumulus,	Cumulostratus,	Nimbus.
13	5	24	1	17	28	15

A SCALE OF THE PREVAILING WINDS.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Days.
3	10	2	3	0	6	2½	4½	31

RESULTS OF A METEOROLOGICAL JOURNAL FOR MARCH, 1826.

(*Continuation.*)

OBSERVATIONS.

The first part of this month was alternately wet and dry, but mild for March; the latter part was dry, windy, and very cold. From the Vernal Equinox to the end of the month, with the exception of one day, the temperature of the air decreased considerably, with smart frosty nights; and a heavy equinoctial gale blew seven days and nights from the North and North-East. The 23rd was a cold Winter-like day, with snow from 9 till 11 A.M.; but, from the dampness of the air, it was not adhesive either to the trees or to the ground, and was the first we had had here during the past Winter: it again snowed in the night, and by the morning it had covered Portsdown Hill. Snow also fell here on the 26th, which was the coldest day and night since the 28th of last January. Heavy snow, showers, and boisterous winds were also experienced in other parts of the country, particularly to the Northward. Early in the morning of the 27th the ice was one-third of an inch thick, and in the mornings of the 30th and 31st it was one-eighth of an inch thick. This ungenial weather was a seasonable check upon the budding of the fruit-trees, and has therefore made the Spring rather backward; but this will, no doubt, be beneficial in the end. An early Spring, with variable weather, is much dreaded in this latitude, as the frosty nights which almost invariably ensue, have a destructive effect upon the young fruits and vegetation. The mean temperature of the external air this month is one-third of a degree less than that of last month. The *maximum* temperature occurred in the night of the 6th, instead of in the day. Spring water seems to have arrived at its *minimum* temperature, as it is now at a stand. On the morning of the 31st two beautiful *parhelia* and a fine solar halo appeared between eight and nine o'clock. The first parhelion, on the South side of the Sun, was visible from eight till half-past eight, one degree without the exterior colour of the solar halo, and twenty-three degrees distant from the Sun's centre: it varied in shape, being sometimes circular, at other times gibbous and oblong, according to the motion and density of the almost invisible vapour in which it was formed by the reflected rays of the Sun; and the orange, light yellow, and blue colours, with which it was embellished, were sufficiently vivid to be traced through a passing attenuated *Cirrostratus* cloud. The other parhelion, on the North side of the Sun, which appeared from half-past eight till a quarter to nine, was not so bright in its primitive colours, in consequence of the most dense part of the vapour having passed off by means of a fresh wind from the North-West, but its distance was the same from the Sun's centre, viz. 23 degrees. The solar halo was well defined, its horizontal diameter was 44 degrees, and its whole area presented a lake colour, bounded by a turbid red, whilst that part of the sky in its vicinity was gray.

The atmospheric and meteoric *phenomena* that have come within our observations this month, are two *parhelia*, two solar and two lunar halos, three meteors, one rainbow, and thirteen gales of wind, or days on which they have prevailed, namely, one from the North, seven from the North-East, one from the South-East, and four from the South-West.

NUMBER NINE.

Sir,—The properties of the above number, to persons conversant with figures, is infinite—in short, multiply it by any figure you will, the product, in its component numbers, is nine. Thus, for example :—

1	2	3	4	5	6	7	8	9	10
9	9	9	9	9	9	9	9	9	9
9	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.1	9.0

After 9 is multiplied by 5, the products are in figures reversed, as thus :— 9 times 5 is 45, 4 and 5 = 9, and 9 times 6 is 5.4, 5 and 4 = 9; 7, 8, 9, and 10, are 4, 3, 2, 1, in same manner.

11	12	13	14	15
9	9	9	9	9
9.9	108, 1 and 8 = 9	117, 1, 1, and 7 = 9	126, 1, 2, and 6 = 9	135, 1, 3, and 5 = 9

16	17	18
9	9	9
144, 1, 4, and 4 = 9	153, 1, 5, and 3 = 9	162, 1, 6, and 2 = 9

19	20
9	9
171, 1, 7, and 1 = 9	180, 1 and 8 = 9

Here the figures are reversed when multiplied by 17, 1.53; by 15 they are 135, and so on as far as 20.

21	22	23
9	9	9
189, which forms 1 and 8 = 9 and 9	198, the same	207, 2 and 7 = 9

24	25	26	27
9	9	9	9
216, 2, 1, & 6 = 9	225, 2, 2, & 5 = 9	234, 2, 3, & 4 = 9	243, 2, 4, & 3 = 9

Now try it in any three figures, thus :—

487	672	934	555
9	9	9	9
4383	6048	8406	4995
3	4	4	9
8	8	6	9
3			5
18 = 1 and 8 are 9	18 = 1 and 8 are 9	18 = 1, 8, are 9	27 = 2 and 7 are 9;

or 3 times 9 is 27 : or the first and last figure in the product 4 and 5 are 9, and the middle are both nines already.

In four figures, thus :—

2768
9
24912, added together, make 18 = 1 and 8 = 9.

Or take the first *two* and last *two* figures in the product, they make nine, and the middle figure is 9 as it stands.

Or 8753
9

78777, added together, is 36; 3 and 6 are 9, and 4 times 9 are 36.

In five figures, thus :—

40320, 4, 3, and 2, are 9,
9

362880, added together, 27, 2 and 7 are 9, or 3 times 9 are 27.

It is said that the total number of changes that may be rung on *nine* bells is the above product, 362880, as thus :—

9)362880
8)40320
7)5040
6)720
5)120
4)24
3)6
2)2
1

2 and 7 are 9 | 3 and 6 are 9 | 4 and 5 are 9 | 5 and 4 are 9 | 6 and 3 are 9

3 times 9 are 27 | 4 times 9 are 36 | 5 times 9 are 45

6 times 9 are 54 | 7 times 9 are 63.

7 and 2 are 9 | 8 and 1 are 9

8 times 9 are 72 | 9 times 9 are 81.

This shows the difference between adding and multiplying.

Nine being a *puzzling* figure to young heads at figures, when they have to multiply by it, they might adopt an easier, thus :—

6782 by 9,
9

61038

say 6782 by 10,
10

67820
6782

61038

Should any of these calculations meet your approval, by inserting them they may induce some abler adept to decipher more on the subject. Meantime,

I am, Sir, your obedient servant,

IKEY PRINGLE, 2, 3, 4 = 9.

MR. SHUTTLEWORTH'S ROTATORY MOTION.

SIR,—I hope I shall not be deemed intruding, if, according to Mr. Shuttleworth's desire, I, for one, state my opinion concerning his Rotatory Motion. If, according to his plan, the rim of the wheel and the steam-box form a cylinder, by what means does he intend to keep it steam-tight? or by what means does he intend to keep the steam from escaping to the outside, when the partitions of the wheel come to the centres of the chambers in the steam-box. Besides, I cannot see how it can produce a motion; for when the steam passes from the boiler to the box, it will certainly act against both the partitions in the wheel with equal pressure, consequently, it will not move at all; and if it is moved, the steam will escape both ways at once.

I remain, Sir,

Your obedient servant,

WILLIAM FINCH.

Bermondsey, April 3, 1826.

NAPIER'S BONES.

SIR,—In Number 135, there is a very neat drawing of Lord Napier's Rods or Bones, by Tauntoniensis. Now, as I have never seen them before accompanied by D and E, I should feel obliged if Tauntoniensis, or any other of your respectable readers, would inform me of the *use* and *application* of D and E.

The right hand column of D seems to me to be the roots of the other two columns, viz.—the cube root of the left hand column, and square root of the other one; but E, I cannot so clearly understand. Perhaps it would not be troubling Tauntoniensis too much, to show how the product of 7304 by 15060, is to be found by the rods.

I am, Sir,

Yours respectfully,

CLYDE.

INQUIRY.

NO. 181.

STEAM-ENGINE MACHINERY.

SIR,—I beg permission, through the medium of your widely extended Journal, to ask a few questions relative to the Conical Pendulum, as now applied for the regulation of Steam Engines.

First, What is the weight or diameter of the balls?

Second, What is the length of the pendulum rods?

Third, What is the distance from centre to centre of the balls, when attached to the rods?

Fourth, At what velocity will they expand?

Any information on the above subject will greatly oblige,

Your obedient servant,

J——S.

NOTICES TO CORRESPONDENTS.

Communications have been received from Migrator—S. P.—An Old Friend—Radix—W. Scholefield—Carbius—Ignis—A Sawyer—W. Spence—A Committee-man—M. D.

The papers of Alex and D. D. never reached us. They had better inquire into the cause of their miscarriage.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

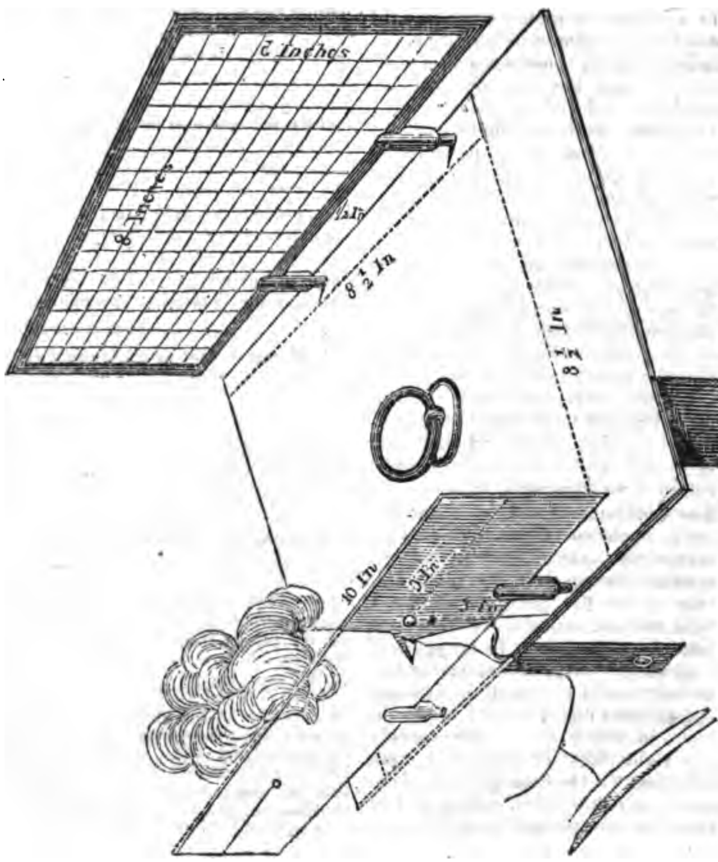
Printed by MILLS, JOWETT, and MILLS (late BENSLEY), Bolt-court, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 140.] SATURDAY, APRIL 29, 1826. [Price 3d.

DESCRIPTION OF AN APPARATUS, BY MEANS OF WHICH THE MOST COMPLICATED AND IRREGULAR OBJECTS, MODELS, MACHINES, BUILDINGS, LANDSCAPE VIEWS, ETC. MAY BE ACCURATELY DRAWN WITHOUT A PREVIOUS KNOWLEDGE OF PERSPECTIVE.



DESCRIPTION OF AN APPARATUS, BY MEANS OF WHICH THE MOST COMPLICATED AND IRREGULAR OBJECTS, MODELS, MACHINES, BUILDINGS, LANDSCAPE VIEWS, ETC. MAY BE ACCURATELY DRAWN WITHOUT A PREVIOUS KNOWLEDGE OF PERSPECTIVE.

BY MR. WILLIAM SMITH.

(To the Editor of the Mechanics' Magazine.)

SIR,—Before I commence my description of the above-mentioned apparatus, it is proper that I (who have not mechanical genius enough to contrive a mouse-trap) should disavow all claim to its invention. I believe that its construction has been known, and the instrument itself partially employed, for several years. I consider, however, that there still remain a great many persons by whom it might be occasionally used with advantage, who have never heard of its existence; and, as I have laid down as an axiom, that *every communication which teaches practice without theory, is valuable to the man of business*, I hope I may be pardoned for requesting the insertion of this communication in your deservedly popular publication.

Malton, at the end of his "Complete Treatise on Perspective," published in 1783, says—"I shall now show and explain the use and application of an apparatus, by which the most complicated and irregular objects, landscape views, &c. may be accurately drawn without understanding perspective, the best calculated for the purpose of any I have seen or heard of, at the same time simple and easy to be applied. I speak from experience, having frequently made use of it in drawing complicated machines and other objects, in which there were scarcely any right lines, or none that were principal." He then goes on to describe his apparatus, which differs from that now treated of only in such parts as have since been improved upon.* Having, I hope, proved to you, Mr. Editor, and to your readers, that I have no intention of decorating myself with *those laurels* which of right belong to others, I think I had better go on with the description at once.

Description.

The apparatus consists chiefly in a rectangular frame (about 8 inches by 5 is a convenient size); this frame is reticulated with silken threads, all of one thickness† (or it is better with *fine iron wire*), in squares, not exceeding half an inch; if smaller, the drawing may be more accurate.

Being provided with a frame reticulated as above, it must be fixed on uprights, ending at top in grooves, and at bottom screwed into a ground plate (8½ or 9 inches square, if the frame be 8 inches by 5), so that the whole machine may take to pieces and go into a flat box, which will also serve to contain paper, pencils, &c. and may be used as a desk to draw on when taking views. A board must now be provided, 10 inches long and 3 broad, with a sight-hole at 3 inches from one end;‡ and this board must be fixed in uprights, similar to those used for the frame, but made to screw to any height, so that the sight-hole may always be opposite to the centre

* If any *recent improvements* have been made, I am in a state of ignorance respecting them; and, as I am just about to construct another instrument for my pupils to amuse themselves with, during the approaching spring season, shall hold myself the debtor of any gentleman who will furnish me with the requisite information, either through the medium of the Mechanics' Magazine, or by letter.

† Mr. Malton advises thicker wires at every fifth square, beginning from the middle longitudinally; and having made one for the horizon at about one-third from the bottom of the frame, to set off the others from *that* breadthwise; but I have never seen a frame reticulated in this manner.

‡ Mr. M.'s sight-hole was in the centre of a circular plate, about the size of a crown piece. One eye must consequently be shut whilst using it; but the long board above-mentioned completely shades the eye, and precludes the necessity of shutting it. By turning the board, it may be used for either eye.

of the frame.* A small plummet and line, or a spirit level, should be affixed to one side of the frame.

The machine may be either fixed on a large walking-stick, the stump of a tree, the top of a gate, &c. by means of a gimblet-screw, which passes through the centre of the horizontal board that supports the frame and sight-hole.

In copying any model or machine, the apparatus may be used upon a table, and the frame may be fixed lengthwise or upright, as the figure of the object may require. The sight-hole should be as far from the frame as *that* is wide (in our apparatus 8 inches), in which case, the whole view will not exceed an angle of 50 degrees.

The whole of the apparatus being fixed for use, the landscape before it will appear on the threads, from the sight-hole, as a drawing reticulated or squared, which may be copied on paper, the same as a print or drawing; but great care must be taken that the sight-hole be not moved after you have begun the drawing, as the places of the objects on the wires will vary thereby. Let your paper be squared in the same manner as your frame, *but in any proportion you please.* To describe the operation of drawing from this frame would be trifling, as it is evidently the same as copying a picture or drawing of any kind.

There is another method of taking representations of objects from nature, which is, by having a plate of glass, well ground and polished, fixed in the frame instead of threads, which must be lightly smeared over with gum-water; when dry, it may be drawn on with a soft pencil, or French chalk, and by that means the objects may be traced on it, the eye being fixed at the sight-hole, and afterwards taken off by tracing the same on paper, opposed to a strong light.

I am, Sir, yours, &c.

Wm. Smith.

Academy, Guildford, April, 1826.

* Mr. M. says, opposite to the horizon. By the bye, Mr. M. had a cross piece, instead of a horizontal board, and a large stick, to drive into the ground, affixed thereto—*thus shutting the whole into a nut-shell, as we do in these modern times.*

SWEDISH CARPENTERS.

From Travels in Sweden, Norway, and Denmark,

BY WILLIAM RAE WILSON, ESQ. F.S.A.

In the court-yard of the inn at Jionkaping, my attention was attracted by a very clumsy operation on the part of two carpenters, which showed how far behind this description of persons are to those in Britain with respect to dexterity. They happened to be occupied in planing planks for the floors of houses. Now, although none of the boards exceeded five feet six inches in length, and four in breadth, nothing could appear more absurd and unnecessary than this trifling piece of work should require the manual exertions of *two* persons. A plank, for instance, was first laid on a bench, when each took his station at the opposite ends, and appeared to be labouring hard at work. One held the body of a plane in his right hand, on the top of which and next to him was fixed an upright wooden pin, which he took by the left. Two pins were also placed on the top at the other end of it, which the second laid hold of with both hands, so that when the former pushed the tool forward along the wood, the other drew it to him, not only under an idea that this occasioned a greater degree of force, but that the work was executed with more facility and rapidity! What appeared, however, more extraordinary was, that a small plane, measuring only one foot and a quarter in length, and three inches and a half in breadth, was used in a similarly awkward manner. Hence the most ignorant country carpenter in England will be found to perform, within the same few minutes, five times more work than they did in this manner; and he would naturally consider, that any hands which touched the plane beyond his own would create an incumbrance, and embarrass his operations.

MAGNETISING STEEL.

SIR,—In answer to your Correspondent, H. R. W., in Number 137 of your valuable Journal, who requests to know whether it be possible to communicate Magnetism to a piece of Steel Wire, by means of a large electrical battery, without making use of an helix; I hesitate not a moment in advancing an opinion, that the spiral, or a mean capable of exerting a similar influence on the steel, is indispensably necessary to excite its latent magnetic principle: and this opinion I incline to assume, not only from an observation of the mode of action apparently employed by electricity in exciting the principle of magnetism, but from the invariable result of an extended course of experiments instituted for the purpose of ascertaining that fact.

Your Correspondent also mentions the fact of a needle, enclosed in a glass tube, hermetically sealed, and surrounded by an helix, becoming instantaneously magnetic, on the charge of three jars being passed through the surrounding wire; and requests to know if there is any theory existent capable of explaining the phenomenon. The only theory which has come under my observation, and which throws any light upon this interesting fact, which has so long been a stumbling-block to the writers on electro-magnetism, is the ingenious and interesting theory of this science by Mr. Buxton, which, I think, does in a great measure, if it does not entirely, elucidate this at first sight inexplicable phenomenon; if you will, therefore, permit me so far to trespass on your valuable pages, by inserting a few of the positions laid down by this gentleman, I doubt not that, if your Correspondent be not quite satisfied, that he will at least be possessed of a wider field for inquiry, and more rational materials to assist him in his researches, than have been hitherto furnished by any anterior theorists on this interesting but imperfectly known science.

Mr. Buxton commences by questioning the assumption which the former writers on the subject had invariably regarded as their first principle, viz.—the *identity of electricity and magnetism*, which he proceeds to show is a position too hastily admitted, by observing in them a similarity of phenomena, without observing the particular circumstances under which these phenomena are made sensible, or the particular objects upon which their influence is exerted; and after recounting a few of the incongruities of these two principles, justly arrives at the conclusion, that they are neither identical or, in fact, similar. He, in the next place, assumes, from the result of experiment, where he claims a a priority to M. Arago, that *all* metals are possessed of the magnetic principle, and mentions several facts, of gold, silver, brass, &c. being permanently magnetic. He then attempts, in a very ingenious manner, to explain the mode of action employed by electricity in exciting the latent magnetic principle of metals, in which he supposes that electricity is no further concerned, than as one of the many agents employed by nature (such as filing, drilling, &c.) to awaken the latent magnetic principle, and that these bear no other relation to one another than as cause and effect.

In explaining this part of his theory, he supposes the dormant magnetic principle to be awakened into action by the attraction of the moleculæ of the metal being temporaneously, to a certain degree, disturbed and suspended, so as to admit of the transmission of the electric fluid, and at the same time affording a similar arrangement for the passage of the heretofore latent magnetic fluid. And, he continues, if the electric force thus employed be but small, and the moleculæ of the metal through which it has been transmitted not sufficiently removed without their mutual sphere of attraction, the magnetism excited will be but temporary; for immediately upon the discontinuance of the electric stream, the parts of the metal, by their mutual attraction, will resume their original physical arrangement, and the magnetic principle will again become quiescent. If, however, the electric stream transmitted through the wire be sufficiently intense to effect a total alteration in the relative situation of its parts, the circulation of the magnetic principle remains constant. But he remarks, that the permanency of the circulation of the magnetic stream seems not so much to depend upon the intensity of the electric stream, as to its direction with respect to the internal structure of the metal subjected to its influence. How far this ingenious exposition agrees with the secret workings of nature, is not for us to decide, and we are no further bound to assent to it, than as it seems to agree with other known and established laws of nature. However this may be, I confess myself a proselyte; and if I be wrong, I have at least the consolation of

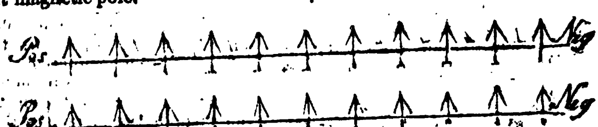
knowing that I have not yet arrived at the state of bliss described by the poet—

"Felix qui potuit rerum cognoscere causas."

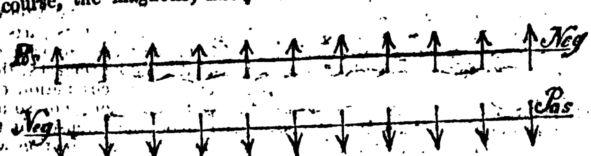
This latter position, however, appears extremely plausible, and, as I think, strictly according to the laws of nature; for it may be observed, that lightning-rods will in a short time acquire a permanent state of magnetism when in a vertical position, and at right angles with the general course of the electric stream; in which case their acquired polarity will be coincident with the planes of their longitudinal direction; but when the direction of the stream and the longitudinal planes coincide, a permanent magnetism, either naturally or artificially, is seldom acquired; and when it is, it will be found in the transverse plane of the rods. In order to make this part of the theory better understood, I will quote the author's own words:—

"The direction of the route of the magnetic fluid seems to be at *right angles*, or nearly so, with the direction of the route of the electric. Thus, when the electric fluid is transmitted in the *longitudinal direction* of the metal, the magnetic will move at right angles with it, and, accordingly, transverse of the metal; but if the electric stream take its course *transverse* of the metal, as by means of the *spiral conducting wire*, the magnetic stream will still move at right angles with the electric, and consequently in the longitudinal direction of the metal, each extremity of which will possess a different magnetic pole."

In order to show that the action of a wire, during its transmission of the electric fluid upon a magnetic needle, is not an immediate electric effect, our author made use of non-metallic conductors, which had no effect upon the needle; we can no longer, therefore, entertain any idea of an identity of electricity and magnetism, for were these one and the same thing, the non-metallic substances should have exerted the same influence over the needle as the metallic, according to their several capacities as conductors of electricity. This, however, was not the case; and we may therefore conclude, that the deflection of a needle by an electrized wire is not immediately dependent on electricity, but on magnetism; and that the different results arose from one class of substances being incapable, and the other capable, of magnetic excitation. He demonstrates that the route of the magnetic particles move at right angles with the electric, by an experiment, which shows, that when two electric streams are transmitted in the same direction, through two wires freely suspended, and within the sphere of mutual attraction, as the magnetic particles in each preserve their relative situation with the direction of the electric stream, and as the respective routes are at right angles to one another, unlike poles, being opposed, the result is, according to the laws of magnetics, a mutual attraction. Thus, in the following figure, the lines PN PN are two wires, NN being connected with the negative sides of a battery, and the arrows denote the direction of the magnetic particles.



On varying the direction of the electric stream in one of the wires, and with it, of course, the magnetic, like poles being then opposed, the wires are mutually repelled, thus,



With respect to the needle becoming magnetic when enclosed in a glass tube, hermetically sealed, he justly observes, that did this depend immediately upon the action of electricity, we must admit that glass is permeable by that principle, and consequently renounce the theory of the Leyden jar; but if we look to Mr. Buxton's theory for an explanation of this phenomenon, we shall find it strictly to accord with the laws of electricity and magnetism; for he proves that a wire,

during its transmission of the electric fluid, is actually a magnet, and, as such, is capable of communicating its magnetic influence even through glass: and as to the difficulty which occurs in rendering a wire permanently magnetic, by passing a shock along its longitudinal plane, this arises from the aforesaid law, that the electric and magnetic fluids move at right angles to one another; for as the route of the magnetic fluid is naturally coincident with the plane of the containing bar, it must necessarily require a far greater intensity to excite it in the transverse; and this also obtains in nature; for though we have circumstances of bars of iron being excited with lateral polarity by means of lightning, yet these causes are not at all common.

Permit me, Sir, to subscribe myself,

Your obedient servant,

J. S. T——a, M.D.

Knightsbridge, April 1826.

ON THE NATURAL STANDARD OF MEASUREMENT.

Sir,—I have perused, with much interest, an Essay, written by S. Thurleigh, on the Natural Standard, page 70, vol. iv. of your Magazine, and very much regret that I had not an opportunity of seeing the "scientific communication of T. H. Pasley" on the same subject; but that before me is so explicit, and so clearly defines the desideratum required, that I think those who have read it must plainly perceive the utility, if not the absolute necessity of some natural standard, and desire, with myself, to thank him for the information he has given on a subject which I may acknowledge I never before thoroughly comprehended, and of course could not be fully aware of the difficulties to be surmounted.

Since reading the article above-mentioned, and also another from your Correspondent Emilla, I have been induced to turn my attention to the subject, and though the result obtained from the method I am about to propose, may, perhaps, not be mathematically exact, yet I incline to forward it to you for insertion in your useful Magazine.

The plan I would suggest is founded on these premises (though perhaps they may be unphilosophical), viz. that equal quantities of a liquid will pass through a tube of a certain size in equal times, provided that the temperature and density of the atmosphere be the same. Now, having stated the principles upon which I have formed my theory, I shall proceed to explain it in detail.

There must be a glass tube, similar to that of a thermometer, with a bowl or globe on the top, the bore in which tube shall be perfectly circular, and of such a size as to allow twenty drops of proof brandy to pass through in exactly one minute in a vacuum (I prefer brandy on account of its colour, its having been distilled, and exemption from many of those impurities which water would be liable to contain); and, that the density or rarity of the atmosphere may have no effect, I would have the tube, after the bowl or globe has been nearly filled, placed perpendicularly in the receiver of an air-pump; and that the uncertain heat of the surrounding air, or the different temperature of the brandy may not operate, the experiment should be made only when a well-regulated thermometer stands at 42 degrees of Fahrenheit. After the air is exhausted from the receiver, the aperture at the bottom of the tube must be unstopped. Now, as the number of drops would always be the same in the same space of time, I imagine that they would always be of the same size, when uninfluenced by atmospherical changes. After ten drops have fallen unregarded (to prevent any irregularity the opening of the aperture might occasion), I would count 100 drops, or any other convenient number which should fall into a moveable vessel previously placed in the receiver for the purpose, and these should then be immediately and accurately measured, one side of the cubical contents of which should be called unity, or one; or, what perhaps would be more easily accomplished, and yield a more exact result, is that under the brandy fall into a scale, then weigh (either in air or vacuum, as would be most proper) the allotted quantity against perfectly pure gold, that being the metal I should think least likely to vary, which gold should be formed into a square bar, the length of which should be just twice the sum of all its sides. The length of this gold bar should be the standard of measurement and capacity.

Another method, more accurate if not more simple than either of the preceding, I should think would be this:—Instead of having the tube nearly resembling that of a thermometer, as before proposed, let it be made with a bowl or

half-globe *at each end*. When it is intended to be used it must be broken in two near the middle. After one of the pieces is prepared with the spirit, and fixed in the receiver near the top, as before directed, let the other be fastened below the upper tube, on a lever, with the bowl upwards (its lower end having been previously stopped), which bowl will perform the service of a tunnel, and catch what falls from the tube above. The lever must be capable of being moved on the outside of the receiver, so as at pleasure to place the tunnel under the orifice. After a few drops have fallen into the receiver, as before observed, and twelve drops into the lower tube, the distance from the surface of the liquor to the bottom of the tube may be the standard of length. But, in performing this experiment, it will be necessary that the bore of the lower tube should be *exactly* the same as that of the upper. I do not know whether I have expressed myself so as be distinctly understood; if not, I shall be happy at some future time to explain.

You will readily perceive, that the care taken to regulate the number according to the time, is merely to make uniform the spherical contents of each drop, which would otherwise be apt to differ.

Should any objection be made as to the difficulty of obtaining a tube of exactly the requisite diameter, that, I think, might be obviated the first time, by making the tube first. The number of drops which should pass through *that*, should be the standard number: I have mentioned twenty merely for example.

Now, as I am not mechanic enough to reduce this plan to practice, and ascertain its practicability, so, on the other hand, I am too little of a philosopher to determine its efficacy without an experiment; I therefore request the investigation of some of your readers. If my hypothesis be erroneous, I should be much obliged to some of your able Correspondents to point out in what the error consists, in as explicit and perspicuous a manner as possible; for those who, like myself, have not made much progress in the acquirement of scientific knowledge, as well as many of that class of persons for whose information, I apprehend, your Magazine is principally intended, I believe sometimes experience the disadvantage of but imperfectly understanding the language of the *very learned*.

I am, Sir,
Your obedient servant,
W. C. H.

Kelvedon, Essex.

[C. H. C. X., on the same subject, in our next.]

QUERIES.

To the Editor of the Mechanics' Magazine.

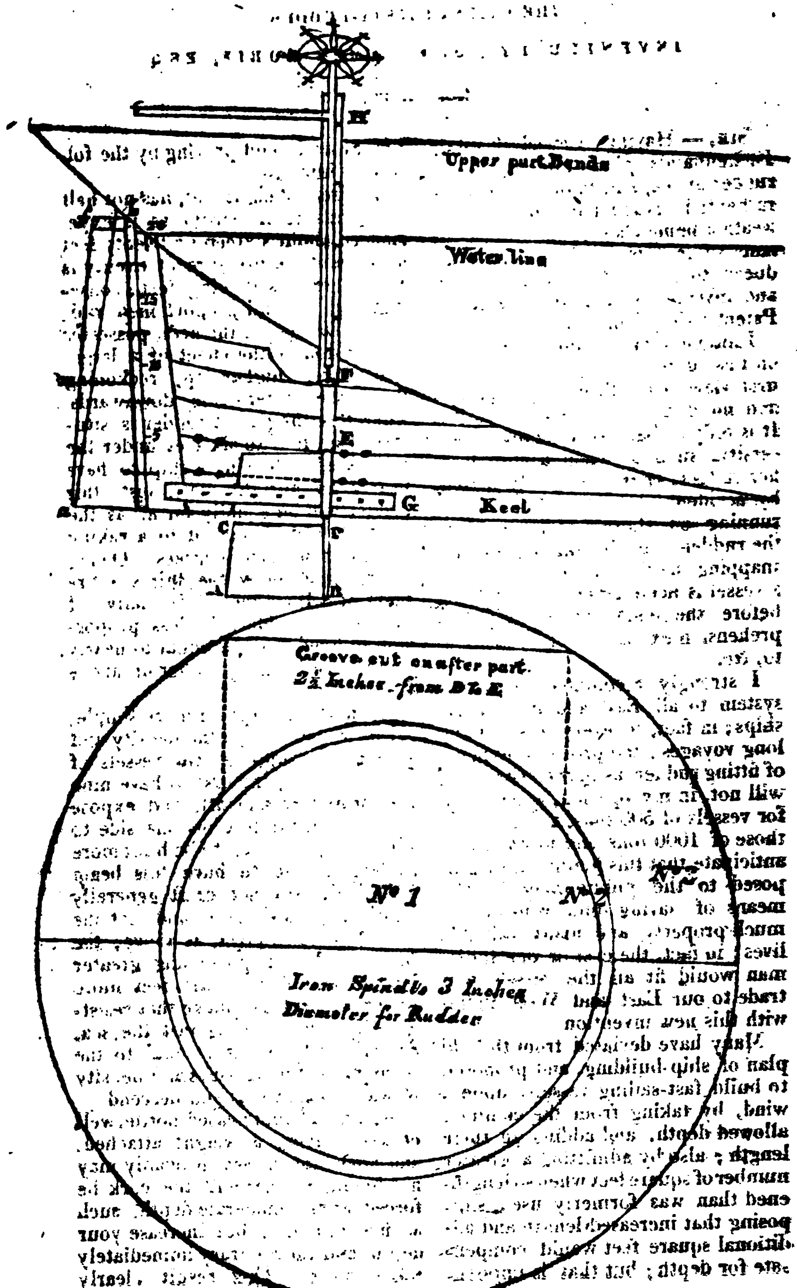
SIR,—The insertion of the following questions in your Magazine may lead to a more familiar explanation than has hitherto been given of them. The more common phenomena of nature often pass unnoticed, and their causes remain unknown, while those which are rare obtain every possible explanation.

What occasions the report of a gun, charged with fixed air (gunpowder)? And why is there no report from the firing of a gun with an equally powerful charge of compressed air?

To what depth is it possible to sink *the lead* in an unfathomable sea? And what is the best method by which to ascertain the density of water at any depth to which a metal may be sunk?

I am, Sir,
Your obedient servant,
L. D.

THE PATENT SAFETY-RUDDER.



THE PATENT SAFETY-RUDDER,

INVENTED BY JOHN JAMES BORIE, ESQ.

Sir, — Having viewed Captain Peckenham's plan for making a rudder at sea, and found the method rather tedious and laborious, very fine weather being also required to fix the same after it is finished, I was induced to find out some substitute, and invented what I shall name the Patent Safety Iron Rudder.

I intend making but few remarks on this subject, as every seaman, on first view, will decide for himself, and no doubt approve of my plan. It is only to be used in cases of necessity, such as when a ship loses her rudder, or is damaged in action, by accident, gales of wind, or by running on shore, carrying away the rudder-head, breaking the tiller, snapping the tiller ropes; also when a vessel is deep laden and scudding before the wind, where any apprehension exists of her broaching-to, &c.

I strongly recommend this new system to all East and West India ships; in fact, to every vessel going long voyages; the probable expense of fitting rudders as thus constructed, will not, in my opinion, exceed 50*l.* for vessels of 500 tons, and 100*l.* for those of 1000 tons and upwards. I anticipate that this method now proposed to the public, may be the means of saving numerous ships, much property, and many valuable lives; in fact, the cost of one Indiaman would fit all the vessels that trade to our East and West Indies with this new invention.

Many have deviated from the old plan of ship-building, and proposed to build fast-sailing vessels, upon a wind, by taking from the common allowed depth, and adding to their length; also by admitting a greater number of square feet when so lengthened than was formerly used, supposing that increased length and additional square feet would compensate for depth; but that is impossible, as we intend proving by the following hints :—

The sea, at eight feet, has not half the pressure or density as is experienced about sixteen or twenty feet deep, and the pressure at twenty is not so great as at thirty feet; consequently, a small-proportioned rudder, fixed close to the keel, possesses nearly double the effect of a larger one placed higher up, reckoning from the water-line downwards. Therefore the patent rudder is situated from four to six feet under the main keel: allowing a ship to have nearly an upright stern-post, this rudder will be equally far aft as the old plan when attached to a raking sternpost of thirty degrees. Owing to its being below the ship's entire body, it will act more effectually: of course a considerable less proportion so fixed must be equal to nearly double the quantity higher up above the dead wood.

To make this appear more simple, let us attend also to the density and pressure. Suppose two vessels of 100 tons each, the first to have nine feet draft fore and aft, and expose 700 superficial feet on one side to the water; the other to be built more in length, and to have less beam and depth; say her draft generally throughout is six feet, and that she has likewise 750 feet, as above,—the latter, although possessing greater length, and fifty square feet more of surface, will not make that resistance by any means against the sea, or drifting to leeward, equal to the former, for the pressure and density of water increase as you descend.

Again: a square cased bottle, well corked, having a weight attached, and hove into the sea, probably may not break, neither will the cork be forced at any moderate depth, such as five fathoms; but increase your depth, and the contrary immediately takes place. This result clearly

points out that a less portion of rudder placed below the keel must act with more certainty than the same quantity above.—[Observe the old and new plans, see the first figure.] The letters *a f* represent the former, and *a b* the latter, diminishing to almost nothing at the top, where the original step stood; the line, *a*, *m*, *f*, represents what proportion it bears to the patent safety-rudder.

The patent safety-rudder will answer all purposes of the common one, more particularly when the ship's way is increased to three miles per hour.

I have tried the invention on several models, and found it to surpass my expectations; therefore, with confidence, I can recommend it to vessels going distant voyages.

Description.

AB, length of the rudder—six feet for vessels of 20 feet draught of water; to be made of wrought iron 2½ inches thick, and tapering to 1½ inch on the after-part. BD, depth, 5 feet on the fore-part.

CD, upper length, 3 feet 6 inches; to be half an inch clear of the keel forward, by three-quarters of an inch on the after-part; the upper part, CD, to taper, so as to admit an easy entrance into the cavity of the main keel, when heaving the whole apparatus up, &c.

DEF, an iron circular pipe, whose sides are 1 inch, deducting 1-10th for friction, commencing from the main-keel to the upper part of the dead-wood; from EF, the tube is to be 1 inch more diameter, so as to form a shoulder for the rudder's spindle to work and rest on. A round knob to be worked on the spindle, to prevent the rudder from descending too low, also by way of gudgeon, or additional security; however, the rudder is so well secured above, and by the iron tube below, that this precaution is almost useless. From D to E a small groove is cut on the after-part, sufficiently large to admit the iron rudder to ascend and descend into the cavity.

o o The round spots, are stop-water plugs drove into the keel and dead-wood; the space between must be well caulked, and the cavity lined with copper throughout.

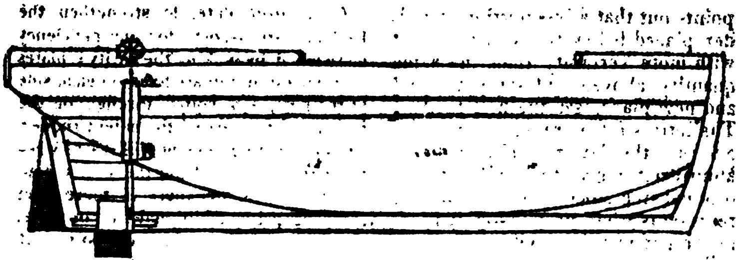
G, an iron plate, to strengthen the keel and stern-post, for any deficiency occasioned by making the cavity; plates of this description are fixed on each side of the keel, and bolted through on the fore and after-part of the patent rudder. The cavity in large ships will scarcely require three inches from the keel's diameter, which weakness is more than compensated by additional iron or metal plates, placed on the sides and bottom of the keel.

FH, is a piece of oak used as a stern-post, for hanging the rudder, with gudgeons, &c. attached; it also forms one side of a square trunk, sufficiently capacious to admit the wooden spindle that fixes on the iron one towards F. In large vessels I prefer this part being of wood, on account of lightness and buoyancy. The wheel and tiller explain themselves, and are to be used as in other ships.

The apparatus is raised or let down, either by a fourfold purchase-block attached to the beam above, and a hand-winch fixed on deck, as is common on board cutters for heaving their mast up; or you may use an iron plate and cogs, similar to that plan frequently adopted about docks and canals for lifting the sluice-gates.

The iron spindle should be three inches diameter; that part at DG to remain a little flattened, whose greatest diameter must run in line with the keel; yet the iron-wrought rudder is to make up any deficiency taken from the spindle, so as to form nearly a circle, as represented in the plate, &c.; the upper end, that fits into the wooden spindle, to have its sides square, and to be well bolted and hooped; the trunk is lined with copper up to deep water-mark.

You may give the iron rudder any angle, or fix it perpendicularly; the best method is to incline it a little forward; the diameter in large ships being only three inches, cannot impede their sailing; on the contrary, it will materially prevent rolling—that object gained, the distance must increase. The rudder may be either iron, copper, or mixed metal; I prefer the former for strength.



The last figure represents a vessel of about 250 tons, with one entire iron tube, from the keel to above the cabin-deck; the rudder spindle, from quarter-deck to keel, is iron; one gudgeon or brace is at A, the other at B.

I am, Sir, your obedient servant,

T. J. R.

WHAT STAGNANT WATERS ARE UNHEALTHY?

Dr. Dwight has a theory that the diseases which are commonly imputed to stagnant waters and marsh miasmata, are produced by animalcular putrefaction. The reasons which he assigns shall be given in his own words (from his Travels in New England), because they may fitly be made the subject of experiment.

"A number of years since I put a quantity of ground pepper into a tumbler of water, and a few days afterwards found a thin scum spread over the surface. Within a few days more, I perceived, on examining this scum with a microscope, that it exhibited an immense number of living animalcules. Two or three days after, examining the same scum, I found not the least appearance of life. After another short period the scum was replenished with living beings, and afterwards became totally destitute of them. This alternate process continued until the water became so fœtid as to forbid a further examination. The conclusion which I drew from these facts was, that the first race of animalcules, having laid their eggs, died, and were succeeded in a short time by a second, and these by a third.

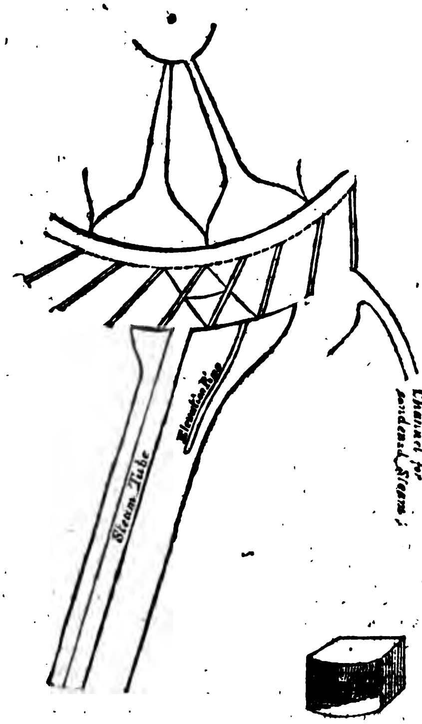
"The fœtor which arose from the putrefaction of these ephemeral beings, differed in respect from that which is produced by the decay of larger animals. Although it was perceptible at a small distance only, and perhaps less loathsome than the smell of a corrupted carcass, it was far more suffocating.

"When the effluvia were received into the lungs, it seemed as if Nature gave way, and was preparing to sink underneath the impression. A pungency, entirely peculiar, accompanied the smell, and appeared to lessen the *vis vitæ* in a manner different from any thing which I had ever experienced before. The scum which covered this pepper-water was, in appearance, the same with that which, in hot seasons, is sometimes seen on standing waters, and abounds on those marshes exposed to the sun. To the production, and still more to the sustenance of the animalcules, vegetable putrefaction seems to be necessary, or at least concomitant; the nidus, perhaps, in which the animalculine existence is formed, or the pabulum by which it is supported.

"Whatever instrumentality vegetable putrefaction may have, I am inclined to suspect, for several reasons, that animalculine putrefaction is the immediate cause of those disorders, whatever they are, which are usually attributed to standing waters. It will, I believe, be found univer-

sally, that no such decease is ever derived from any standing waters which are not, to a considerable extent, covered with a scum; and perhaps most, if not all of those that have this covering, will be found unhealthy. The New England lakes, so far as I have observed, are universally free even from the thinnest pellicle of this nature, are pure potable water, are supplied almost wholly from subjacent springs, and are, therefore, too cool, as well as too much agitated by winds, to permit, ordinarily, the existence of animalcules."

IMPROVEMENT ON THE STEAM-ENGINE.



SIR,—Without any pretensions to mechanical knowledge, but merely conceiving that the above drawing may *possibly* represent a slight improvement upon the Steam-Engine, I send it in hopes that you, or the readers of your Magazine, will satisfy my doubts. You will observe, that I propose to apply the power of the steam at once to the margin of the main-wheel, and to do away altogether with the piston and balance-bar. I confess it appears to me that there are several objections to it—perhaps it might be impossible to prevent the escape of the steam without incurring too much friction, and I may be deceived in the supposition that the pressure of the steam would be in a diagonal direction.

I am, Sir,

Your obedient servant,

X—X.

ACCOUNT OF CHERBOURG BREAKWATER.

(Concluded from page 244.)

(Concluded from page 244.)

SIR,—In my last communication on the Cherbourg Breakwater (the conclusion of which I have been prevented by illness from sending sooner), I briefly mentioned the immense basin constructed by Bonaparte, at an expense of three millions sterling. It was opened on the 27th of August, 1813; and the Emperor, in order to give greater *eclat* to the ceremony, sent the Empress Maria Louisa to be present on the occasion. M. Lair, Secretary to the Society of Agriculture and Commerce of Caen, who has published an account of the event, says, that " when the time arrived for the water to be let in, and the dam broken down, the Empress's approach was announced by flourishes of warlike music, and numerous discharges of artillery. Cries of joy were mingled for a long time with the thunder of the batteries. Her Majesty took her place in the pavilion which had been prepared for her, when the Bishop of Constance, surrounded by his clergy, after making a suitable address to his Imperial Mistress, turned round towards the basin, and blessed this work of man." M. Lair speaks with rapture of the gratification he derived from seeing men, born on the Tiber and the banks of the Guadalquiver (the Italian and Spanish prisoners of war), working under the direction of French engineers, at the establishment of a port in the channel, formidable to the English navy; but he forgets to tell us at what a sacrifice of humanity so many wretched captives were compelled to labour, in chains, at a work for which they were not paid, and in which they could not take the least possible interest.

M. Lair describes this basin to be excavated out of a rock of granite schist, or gneis, the density and thickness of which increased as the workmen descended. He compares it to an immense trough dug out of a single stone, and capable of containing many millions of cubic feet of water. We now know, however, that Mr. Lair is mistaken; that it is not one mass of rock, but rock and gravel united; that the whole of the sides are cased with a well-constructed wall of red granite; and that a noble quay, built of the same material, and extending between the two forts of Galet and Homet, separates the basin and wet-dock from the sea.

The dimensions of the new basin he states to be about 900 feet in length by 720 in width, and the average depth 55 feet from the edge of the quay; and as this edge is five feet above the high water mark of the equinoctial spring-tides, the depth of water in the basin is then 50 feet; and the mass of water, after making allowance for a slope of the solid sides inward, in an angle of 45° from the height of about 25 feet, amounts to about 30 millions of cubic feet; and that it is calculated to contain about 30 sail of the line. There is reason to think that it is considerably larger; about 1000 feet by 770 feet, and consequently contains a surface of about 18 acres, which, at three per acre, will contain 54 sail of the line, and the adjoining wet-dock, when finished, an equal number. The latter is at this time about two-thirds completed, and from 300 to 400 men are employed in blasting the rock and building granite walls. The dyke or breakwater seems to be abandoned; the works having long been stopped, and the stone vessels going rapidly to decay. The French officers say, indeed, that it has occasioned the roadstead to become shallower, by the deposition of sand that has taken place.

The entrance canal leading from the outer harbour into the basin is at right angles to the latter, and its direction E.N.E. Its dimensions are as under :—

	Feet.	In.
Width between the two moles in the direction of their axis	196	8
Width at its opening into the basin	308	8
Length from the axis of the moles or piers to the line of wall forming the side of the basin......	274	0

The basin, having no gates, is said to be excavated to the depth of nine feet below the bottom of the canal, the former having, as before-mentioned, 50 feet water, and the latter only 41 at high spring-tides, which, as they ebb 20 feet, would leave only 21 feet in the passage or canal at low water. This inequality is probably intended to keep the ships afloat in the basin at low water, when the depth in the canal is not sufficient for that purpose; but after so much expense incurred in digging the basin, one would suppose a little more might have been expended in digging the canal to the same depth, so as to let ships pass into and out of the basin in all states of the tide; an advantage of the utmost importance for speedily securing their ships in the basin, when in danger of an attack from the enemy in the roadstead, or of speedily putting to sea and escaping the vigilance of a blockading squadron. No reason is assigned for leaving the basin without gates; but it is thought that Mr. Lair is again mistaken, and that the passage has depth of water sufficient for ships of the largest class to run into the basin at all times of the tide. But even here they do not lie in safety; for the wide entrance facing the N.E. is

covered only in that direction by the Isle Peleé, so that the water in the basin partakes of the swell in the road, which is sometimes so great as to make it necessary to apply ten or twelve cables to hold ships steady in the basin.

Another serious inconvenience is likely to arise from this particular construction of the basin. Whatever silt or mud is carried in by the tides must be deposited there, and cannot possibly escape. The quantity is probably not very great in the water of the Channel opposite to Cherbourg, but, higher up, towards Ostend, it is very considerable. When we took possession of that port, it was found that, in the course of the Revolutionary war, the harbour, by neglect, was filled up with six or seven feet of mud.

Several pieces of cannon are intended to be mounted on the two piers, to protect the entrance into the basin. On one of them is likewise placed a light-house, and on the other a Semaphoric telegraph. In the centre of the same side of the basin, with two slips on each side of it, a noble dry dock was cut out (or built rather) of solid granite, in which ships of the largest class might be built or repaired. Its dimensions were—

	Feet.	In.
Length	230	0
Width	74	0
Depth	26	6

Thus the ships built on the four slips may be launched into the basin, and at once docked out of it.

But few store-houses, or other buildings necessary for a naval establishment, are yet erected; but there is an ample space laid out for every purpose that can be required to make Cherbourg one of the first naval arsenals in Europe; and a narrow canal, between the walls of Fort du Homet and the wall of the wet-dock, leads to a most convenient space for mast-ponds and mast-houses.

The fortifications for the protection of the anchorage in the roadstead, and the new naval arsenal, are—1. Querqueville. 2. Fort du Homet. 3. Fort du Galet. 4. Fort Royal, on Isle Peleé. Fort Royal, and Fort du Homet, have circular faces towards the sea, with each two tiers of guns, and turrets above them; the former mounts about 80 guns, the latter 65, and Querqueville about 30 guns.

The principal channel from the road to the sea is at the western end of the breakwater, which, for large ships, is not more than half a mile in width; and this want of space will always make it difficult for ships of the line to work out; but, on the other hand, a fleet may push out to the westward in southerly winds, which lock up the English ports in the Channel.

The eastern channel is a very indifferent one; and, from the position of the Isle Peleé and the main, is likely to become worse, from the accumulation of sand, which the French officers say is actually the case.

Such as are here described were the mighty preparations of that extraordinary man for the destruction of the naval power of Great Britain, and, with it, of the national glory, pride, and prosperity; which, whether elated with success, or depressed by reverses, he never attempted to conceal as being the object nearest to his heart; and he had sufficient cause for his hatred, well knowing that it was England, and England's navy, that opposed the only obstacle between him and the subjugation of the world to his dominion.

I am, Sir, yours, &c.

******.

TEMPLE OF EPHESUS.

The Temple of Diana has been long celebrated for its magnificence; but little has been hitherto known of the style in which it was constructed. The following description of it we extract from a very useful and clever work just published, entitled "Lives of Ancient and Modern Architects:"—

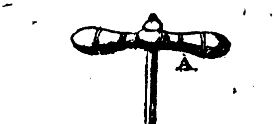
"This Temple was situated out of Ephesus, in a marshy place, at the foot of a hill; such situations being considered by the ancients as least exposed to earthquakes. The expense of forming the drains must have been great, as the stone used for that purpose exhausted all the quarries in the country. These conduits and quarries are now taken for a labyrinth. To remedy any inconvenience which might arise from damp, they very judiciously placed under the foundations strata of charcoal, and then strata of wood. Vitruvius says, that its figure was octastyle dipteral; that is, on all the four sides, there was a double portico of columns, eight of which were seen in front. All the designs which have been made of it by Menestrier, Perrault, Fischer, and Aulisio, are imperfect, and little conformable to the descriptions handed down to us. The ruins are still seen, but no idea of its original form can be obtained. The best description is that by the Marchese Poleni, which is to be found in an Essay of the Academy of Cortona. The ascent to the portico was by ten steps: Vitruvius had not then given his rules why they should be of an uneven number. The length of the portico was 398 feet, and its width 193. The intercolumniations were two diameters and a quarter; the length of the

cell 245 feet, and its width 63 feet. At one extremity was a niche, in which was a statue of the goddess. The temple was ornamented with 127 columns of fine Parian marble, of the Ionic order, sixty feet high; thirty-seven of which were the gift of as many Kings, and were exquisitely worked. Among these, one by the celebrated Scopas was the most admired. A small statue of ebony, representing Diana, which some fanatic or impostor had said had fallen from heaven, furnished the occasion for raising this temple, to the construction and embellishment of which all Asia Minor contributed with the most fervent zeal. This great work was in hand for two hundred years, and was finished by Demetrius, a servant of Diana, and by Paonius of Ephesus; but it did not remain long, as Erostratus set fire to it, to render his name immortal. From the same motive, a courtier of Charles V. threw his father and himself from the church of St. Peter in the Vatican: to acquire fame, Democritus put out his eyes, if such a thing is possible, and laughed; Heraclitus cried for the same purpose, and Diogenes lived in a tub. If we were to take an account of all the follies committed by men to render their names famous, that of Erostratus was not the most absurd. The Ephesians forbade his name ever to be pronounced; which surely was the very way to immortalize him. It is said, that Alexander the Great, who, by his false idea of glory, produced so much evil, wished to rebuild the temple at his own expense, on condition that his name alone should form the inscription. The Ephesians rejected his offer with courtesy, replying, that it was not consistent for the god Alexander to erect a monument to a goddess. The expense of rebuilding the temple was afterwards defrayed out of the public money; and it was made much more magnificent than before, under the direction of the architect Cheiromocrates, or Dinocrates: and thus good was produced from the folly of Erostratus, who burnt it with the same feeling of vanity that induced the Ephesians to re-erect it: and he claims some thanks for not having destroyed the city entirely; or provinces and kingdoms, as some conquerors have done. But it is scarcely possible to imagine how a fire could consume an edifice of stone: it is possible, however, that the roof, and some rooms within it, might be of timber; and these, together with the sacred utensils, would consequently be consumed. We may also admit, that the burning embers might have fallen on some of the capitals, and broken them, as well as discoloured the marble; but even this would not render the rebuilding requisite, or alter the plan: they therefore only cleaned the marbles, repaired the columns, and new roofed it. It is thus we can explain how the people of Ephesus were capable of restoring that structure, to which so many cities and kings had contributed. This superb edifice was destroyed by the barbarians in the third and fourth centuries. Many of its finest ornaments now adorn the mosques at Constantinople."

IMPROVEMENT IN THE AIR-GUN.

Sir,—I have used the Air-Gun in shooting rooks, but have been almost deterred from it by the danger which attends charging the air-ball at the *top* of the pump. Some time ago, an acquaintance of mine was in the act of charging the ball, when it burst, and killed him on the spot. It occurred to me that an improvement might be made which would prevent the danger of being hurt in this way. Let the pump be reversed, the ball be screwed on at the bottom part, and a piece of iron attached to set the feet on, and so made as to cover a great part of the upper side of the ball, as in the figure.

I remain, Sir,
Your constant reader,
T— S—.



Description.

A, the handle or piston.

B, the barrel.

C, the foot-iron: this might screw off the barrel, for convenience of carriage.

D, the ball, screwed to the barrel.

AIR-BUOYED BOAT.

It was lately stated in some of the West of England Papers, that an experiment had been made by Capt. Spencer, at Lyme, on a common jolly-boat fitted with copper air-trunks, cased with deal. We are informed that the same experiment was tried five or six years ago, on a common eighteen-feet jolly-boat, fitted by order of the Honourable Navy Board, under the inspection of Mr. Joseph Helby, now of Stoke-Road, near Gosport, with copper air-trunks, at Sheerness yard; and that with the plug out (of 3½ inch. diameter), and twelve men in her, the water did not rise over the thwarts. This boat was issued to the Hon. Captain Spencer, and is said to have been since left at Gibraltar, as a life-boat.

BEER ENGINES.

One of the simplest and most useful Machines of the present day, is that which is now commonly used in our inns, whereby the liquor is drawn from the cask without the trouble of going into the cellar, or the risk of dishonesty on the part of the tapster. It is a simple air-pump, connected with a leathern or metal pipe, made air-tight, which being exhausted by the pump, the liquid is forced by the mere pressure of the atmosphere into the tube, to fill up the vacuum which has been created, and thence passes on in a stream, which may be stopped or continued at pleasure.

ANSWER TO INQUIRY.

PAINTING ON GLASS.

SIR,—In answer to M. de C—, I would beg leave to inform him, that it is impossible to paint on glass unless it is ground previous to painting. When so prepared, the paint is to be laid on in the common method, as on paper.

I remain, Sir,

Your obedient servant,

MENTOR.

NOTICES TO CORRESPONDENTS.

Philtre's communication shall have an early place. The other contributions, which he promises from the same source, will be acceptable.

J. K. L. will find a letter addressed to him at Peele's coffee-house, on Monday.

Dædalus, on Ærostation, probably in our next.

Pictor is so illegible that we must request he will favour us with a fairer transcript of his ideas, which, as far as we can decipher them, seem good.

The subject of Patents, on which "Observer" so justly animadverts, shall be fully discussed at the commencement of our next volume.

Communications have been received from Commentator—Mr. Butler—S. M.—T. Clark—David—S. Tomson—W. W.—D. Young—L. L. M.—Y. X.—Z. Z.—A Youngster—A Young Engineer—A Carpenter and Joiner—C. M. M.—T. S. R.—A Blacksmith—L. L. D.—T.....r—C....m—A Subscriber—C....s—S...n Smithson—R. Kent—J. K.—W. Thompson.

*** *Advertisements for the Covers of the Monthly Parts must be sent to the Publishers before the 20th day of each Month.*

END OF THE FIFTH VOLUME.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by *Mills, Jowett*, and *Mills* (late *Bensley*), Bolt-court, Fleet-street.

INDEX

TO

VOLUME THE FIFTH.

A

B

C

INDEX